# SOME PHILOSOPHICAL ORIGINS OF AN ECOLOGICAL SENSIBILITY

A Dissertation

by

CHARLES ROYAL CARLSON

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

August 2012

Major Subject: Philosophy

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Approved by:

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| Chair of Committee, | John J. McDermott |
| Committee Members, | Scott Austin |
| | Theodore George |
| | Gil Rosenthal |
| Head of Department, | Gary Varner |

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# ABSTRACT

Some Philosophical Origins of an Ecological Sensibility.

(August 2012)

Charles Royal Carlson, B.A., Augustana College;

M.A., The University of Toledo;

M.S., Texas A&M University

Chair of Advisory Committee: Dr. John J. McDermott

This dissertation is centered on problems within the history and philosophy of biology. The project identifies the philosophical roots of the current ecological movement and shows how a version of philosophical naturalism might be put to use within contemporary ethical issues in biology and aid in the development of research programs. The approach is historically informed, but has application for current dilemmas. The traditions from which I primarily draw include classical American philosophy, particularly C.S. Peirce and John Dewey, as well as thinkers associated with the German *Naturphilosophie* movement, such as Goethe and Schopenhauer. There are deep, but often overlooked, resonances between these seemingly disparate traditions and contemporary biology that are located in the conflict between the developing organism and the ever-fluctuating environment. The dissertation makes the case for a shared description of nature among these traditions and proposes applications to burgeoning contemporary ecological interpretations of issues such as hybridization and epigenetics.

# DEDICATION

To my teachers. From my first philosophy class with Larry Holzer, to my dissertation director John J. McDermott, from dinner table discussions in my youth with my parents, to the present dinner table discussions with my insightful wife, I have been and continue to be surrounded by open ongoing discussion and exploration.

# ACKNOWLEDGEMENTS

This dissertation was not written in isolation over a short period of time. It has been bubbling, brewing, fermenting and percolating for many years and there have been countless people who have either thrown something into the pot or, or endured the at times noxious odors of its creation. Fifteen years ago I heard my first lecture on Nietzsche and Schopenhauer from a caped man who was passionate about ideas in a way that was inspiring. He seemed to not only not be trying to shake his sense of ill-at-ease but also reveled in it in an honest way. Six years ago I sat in a course on the American philosopher John Dewey and learned what it was to care about students and their interest in the pursuit of these same ideas. Throughout the process I have been surrounded by a community of support that I am both lucky and privileged to have. My advisor and mentor, John J. McDermott, has been generous with his time and person in a way that sets the bar for what it is to be an educator and I am proud to call myself his student. Theodore George has been a consistent font of help and our work together during an independent study in a small classroom three years ago was in many ways the turning point for me being able to bring together the philosophy of biology with the historical traditions of German Idealism and American philosophy. Scott Austin has provided the rare combination of unfailing cheer coupled with difficult and honest questions about the nature of this project. Both have been invaluable. Robert Burch provided significant commentary and advice regarding the work on Peirce. Dan Conway has been

instrumental in keeping the Schopenhauer component of this dissertation alive and connected to the project at large.

Without a doubt I owe thanks to Dr. Gil Rosenthal for taking the chance on a philosophy Ph.D. student whose interest in the philosophy of biology led him to try and "get his hands dirty" by pursuing a masters degree in biology. Although the reaction to the announcement of this endeavor received uniformly 'raised-eyebrows' from almost all quarters, I have never received anything but full and confident support from him, his family and his lab. The Rosenthal lab is the archetype of what it means to be interdisciplinary and I greatly appreciate the patience and tolerance that they showed throughout my time with them. Thank you Brad Johnson, Zach Culumber, Holly Kindsvater, Machteld Verzijden, Michi Tobler, Ryan Easterling, Courtney Passow, Charles Criscione and Adam Jones among others.

The Society for the Advancement of American Philosophy has been a source of strength and provides an example of a philosophical community that is cordial, cooperative, critically engaged and supportive of young scholars. Chapters 4 and 5 began as presentations for this society. Some members who have been invaluable interlocutors, educators, and supporters during my time with this group include: Lucas McGranahan, Trevor Pearce, Charlie Hobbs, Mike Brady, Megan Mustain, Tommy Curry, Gregory Pappas, James Campbell, and Mathew Flamm.

Many more deserve a personal thank you for being with me throughout this quest; please accept my thanks and sincere gratitude.

College Station, June 2012

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# CHAPTER I

## INTRODUCTION

Arthur Schopenhauer writes in an 1815 letter to Goethe his philosophical hero at the time: "The courage to hold no question close to one's heart is that which makes one a philosopher.[1]" Schopenhauer offered this description during a time when scientific revelation was rapidly altering the perception of the natural world[2]. The courage that Schopenhauer suggests to Goethe is not isolated to that one moment. The courage to question the proclamations of the scientific community that are raised to the status of sacred is something that is shared by all of the thinkers under question in this work.

This dissertation explores concepts of nature conceptually outside of the present 'age of the genome' and applies them to contemporary issues: hybridization, sexual selection, and the origins of altruism, among others. The wider aim of the following discussion is the sketching of a synthesized ecological perspective and a call to study, not just genes, but top-down relationships of organism, environment, and the constitutive parts. The project has both a historical/philosophical perspective as well as an applied

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This dissertation follows the style of *American Catholic Philosophical Quarterly*.

[1] Arthur Schopenhauer, *Gesammelte Briefe*, ed. Arthur Hubscher ( Bonn: Bouvier Verlag Herbert Grundmann, 1987), 18. In a letter from Schopenhauer to Goethe dated November 11, 1815. All translations from this text occur in: David E. Cartwright, *Schopenhauer: A Biography* (New York: Cambridge University Press, 2010).

[2] He also can be seen to have thought himself to be part of this undoing and was encouraging Goethe to courageously admit that his additions to Goethe's work on color had surpassed Goethe.

component that attempts to address contemporary problems in the philosophy of biology. The guiding critique is that the reductionistic and deterministic assumptions present in many current conceptions of genetics does not do the explanatory work needed for the most pressing issues surrounding evolutionary change. The primary thesis is that the natural world contains no true particular, that is, every real organic is not isolated from the past and is not ultimately constrained by the future. In other words, Nature takes on habits but remains essentially Wild. I suggest that we can find help by looking at historical figures whose intellectual lenses are not colored by these assumptions and instead look to emphasis the relations among nature that are not determined by one to one causal interaction.

The unified position that eventually emerges from this analysis is a take on evolutionary theory that places interaction with the environment as the primary mechanism of evolutionary change. This is not a new position, but one that has had difficulty gaining traction in light of the immense deterministic explanatory power of the gene. The inability of this worldview to satisfactorily explain recent scientific work suggests that it may be helpful to reevaluate a view that emphasizes development and the active relationships among the moving parts of the biological world. Even though these thinkers are working at different times, in different cultures, and on different problems they share a way of understanding nature that is non-reductionistic and anti-materialist. The benefit of having them be from different contexts is that we can see how this worldview can be applied in a variety of ways to a broad range of concerns. The resulting worldview and understanding of nature can then be shaped and given identity

and used as a tool to examine many of the contemporary problems that biology is faced with.

The choice of figures under investigation is not inclusive of all those that might concur with this criticism, nor do the positions of the thinkers mesh seamlessly with each other. There is a constellation of thinkers that work under this rubric, but including them all would do no service to the task of defining and putting to work the rubric itself. The task at hand is also not to claim that there was at one time a scientific worldview that 'got it right' and that it needs to be saved from its status as forgotten. What can be gathered from these thinkers are specific examples of how we might see the world from an alternative paradigm than the one currently in vogue. They are chosen because they address specific aspects of the major questions of evolutionary change that when taken together offer one way, but not the only way, that a relation centered ecology might construct a metaphysics of nature.

Goethe represents the power that the mind has to represent the entirety of the idea of an organism outside of an individually isolated moment in time. In so doing he offers a more robust identity of a species than is possible with the counting of genetic beans. Peirce offers a metaphysical vision of the world that does not require the principle of sufficient reason to offer strict causal relations between all moving parts. Peirce introduces chance as a real force in nature's unfolding that does take on habits and become increasingly ingrained, but which nonetheless still occasionally swerves and is not programmatically running out causal necessities. Dewey offers an analysis of the relationship between organism and environment that does not pit them against each other

as opposing forces battling for supremecy, but which says that working relationships between the two are those that produce growth in the organism. In Dewey's depiction of nature, the internal constraints of Goethe's morphology are given an ideological partner for external pressures and the resulting constraints. Arthur Schopenhauer presents a vision of an initiating life force that has a blind, yet forward lurching, purpose. He addresses questions about why life is in the first place that is universally applicable and yet accounts for the individuation of living things. Schopenhauer is trying to establish a metaphysical system where every part of reality fits in and that presents a concept of nature that explains every component of nature, including why it changes the way it changes. All of these thinkers have resonances with versions of Darwinian natural selection, but not with the representations of that theory that view nature as a piecemeal machine running without motivation, and yet without possibility of radical divergence.

In all of the figures under study the Kantian warning about the unknowability about some subjects of metaphysics is taken seriously. For instance, there is no certainty about the telos of any biological force. Yet, in each of the thinkers under investigation there is a weaker notion of teleology that does not crowd out the wonder of the empirical experience of nature, the radical change and diversity available through evolution, and that places an emphasis on continuity rather than the mining of separated parts. They are arguing that the theoretical meaning of the big picture is found in the contemplation of the big picture itself, it is a concept of nature as something that is held together rather than built up.

Another major feature that unites the philosophical positions under examination is the self-reflecting question of certainty and the influence that one's perspective of nature, the biologist's eye, has in shaping a metaphysical account of the inner identity of nature. Again, there are other thinkers that are more representative of this rubric, but the emphasis here is on the biological, on the problems directly related to theoretical problems in biology. This limiting of scope occurs also occurs within the philosophies that are directly addressed. Both Peirce and Schopenhauer contended that the unifying metaphysical underpinning of their thought could be applied to laws of nature that described the laws of physics, but the specifics of this extension are not specifically addressed.

Within this stress on the natural world there is a uniquely un-hierarchical account of human concerns. The concept of a unified ecology that does not place humanity at its center has no greater defender than Arthur Schopenhauer, and is in part shared by each of the thinkers addressed. The laws as found in the biological world apply to humans just as they do to plants, fish and fowl. Also, there is little assumption in these thinkers of a unique moral high-ground for human thought. In other words, if ultimate intelligibility is to be found it is found in the investigation of the world that is inclusive of all living things and not simply of those that have the trait of reason.

On the whole, within these philosophies of nature there is a focus on explanation, meaning, and significance that does not require a clear and distinct concept of identity. The result is a conceptual framework that can give value to our observations of the biological world.

The intention herein is to provide a theoretical framework that allows us to help understand the significance of the vast sea of new data, genetic and otherwise, that is being collected with increasing rapidity. The worldview presented has the hope that it can help question the assumptions of the gene centric position and give new angles of inquiry into the meaning of the data. The primary criticism is that instead of thinking of the genome as a complex entity, the task of science is to see that it is atomized. A task that ends up being paralyzing in the search for a coherent thread amongst these complex systems.

In the first chapter we look at Goethe and the naturephilosphen movment focusing on concepts of development. The overarching theme being introduced in this chapter is the idea that nature is complex and that the relations between the complex moving and growing parts is of central concern in any attempt to explain what is going on. The second chapter looks at metaphysical accounts the natural world with a specific focus on one formulation, that being Schopenhauer's concept of the World-Will. Of importance here is the insertion of a view of nature that is distinctly clashing with many assumptions about its fundamental nature. Nature for Schopenhauer is competitive, ruthless, and focused on reproduction through suffering. The impact that the biologist's eye has on our interpretation of biology and behavior will be explored as well. Chapters three and four look at two different dimensions that challenge contemporary notions of genetics through revisions of philosophies of probability and ecology.

# CHAPTER II

## ALL IS LEAF: GOETHE'S METAMORPHOSIS

You find thus in the very sands and anticipation of the vegetable leaf. No wonder that the earth expresses itself outwardly in leaves, it so labors with the idea inwardly. The atoms have already learned this law, and are pregnant by it. The overhanging leaf sees here its prototype...The feathers and wings of birds are still drier and thinner leaves...Even ice begins with delicate crystal leaves...[and] the whole tree itself is but one leaf...Thus it seemed that this one hill-side illustrated the principle of all the operations of Nature. The Maker of this earth but patented a leaf. What Champollion will decipher this hieroglyphic for us, that we may turn over a new leaf at last?

– Henry David Thoreau[3]

Goethe's reputation as a scientist is in many minds an afterthought and is often referenced alongside Newton's theological work as being important for those who study the person but easily discarded by those who take the issues seriously. Sir Charles Sherrington supports this view: "Were it not for Geothe's poetry, surely it is true to say we should not trouble about his science."[4] This is not the venue to attempt to make the case that Goethe's contributions to evolutionary theory were valuable as, of course, much of it has fallen to the wayside for good reason. That being said, Goethe's view of nature and his attempts to understand the development of plants by identifying unified patterns and sources of origin is so diametrically opposed to the reductionist paradigm

3 Henry David Thoreau, *Walden*, ed. Jeffrey S. Cramer (New Haven, Connecticut: Yale University Press, 2002), 295-97. Thoreau was admittedly influenced by Goethe's "all-is-leaf."

4 Charles Sherrington, *Goethe on Nature and on Science* (Cambridge, England: Cambridge University Press, 1942), 23.

presently dominating the scientific worldview that the insights gained by his approach are of great value.

There are two primary themes of Goethe's work that this chapter aims to bring to the forefront. The first is the importance that Goethe gives to the relations involved in the developing plant. The second is the idealist notion of the transcendental leaf: the idea that there is a form not present in any individual stage of the life cycle but as a concept that captures the entire idea the object under investigation. The first concept has echoes in John Dewey's conception of growth as a relationship between external and internal pressures as well the idea of habit-taking as found in the work of Charles Sanders Peirce. The second notion regarding the eye of the biologist provides a conceptual framework that is related to Schopenhauer's argument that our own direct experience of Will gives us a foundational bedding to begin an investigation of the Will of other living things.

Goethe was certainly no reductionist as can be seen in his statements from 1817's *Zur Morphologie* that there are "disadvantages to biology of the analytical approach through chemistry and anatomy." Goethe contends that "by this method, the living creature is dissected into its elements, but that from these elements it is impossible to reconstitute and reanimate it.[5]" In an introduction to Goethe's primary work in botany, Gordon L. Miller emphasizes this point by suggesting that

> …Goethe's science, as with any scientific theory, [has] been variously accepted or assailed. The essential significance of his scientific endeavors, however, lies

5 Johann Wolfgang von Goethe, *Zur Morphologie,* ed. WilhelmTroll (Weimar: Bohlau, 1964), 114-115.

> not in the sum of factual knowledge he contributed but rather in the way of knowing he developed.[6]

It should be noted that Darwin himself was familiar with Goethe's botanical writings, particularly *The Metamorphosis of Plants* and included reference to his ideas within *On the Origin of Species*. Robert Richards has recently written on the scientific influence of Romantic writers, including Goethe and the *Naturephilosophen* movement, and has suggested that "evolutionary theory was Goethean morphology running on geological time."[7] Schopenhauer's philosophy of nature, the subject of the next chapter, could just as easily be seen to reduce evolutionary theory to a single impulse running outside of time but also embodied according to the constraints of Goethean morphology.

His work in botany and the development of plants from seed to reproduction will be the focus of this discussion and has received more sustained support than some of his other work. Beverly Glover supports this contending that *The Metamorphosis of Plants*:

> is first among Goethe's scientific works in terms of favorable, though not unqualified, reception from the modern scientific community. His basic proposition that "all is leaf," commonly known as the foliar theory, has in fact, in the words of a recent text, "underpinned all work on flower development, including modern molecular genetic analysis.[8]

Glover also notes that the genetic work of distinguished biologists Enrico Coen, Elliot Meyerowitz, and others is particularly significant for providing experimental support for the guiding insights of Goethe, as well as for his view that floral abnormalities can

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6 Johann Wolfgang von Goethe, *The Metamorphosis of Plants*, Introduction and Photography by Gordon L. Miller (Cambridge, Massachusetts: The MIT Press, 2009), xxvi. Goethe's *Metamorphosis* was first published in 1790.

7 Robert J. Richards, *The Romantic Conception of Life: Science and Philosophy in the Age of Goethe* (Chicago: University of Chicago Press, 2002), 407.

8 Beverly J. Glover, *Understanding Flowers and Flowering* (Oxford, England: Oxford University Press, 2007), 10.

reveal the inner workings of normal development.[9] Stephen J. Gould, in *The Structure of Evolutionary Theory* discusses the merits of Goethe's theory and provides examples of experimental work that supports the suppositions of the basic foliar theory. [10] These examples are not cited in order to make an argument from authority that his identity as a scientist needs to be validated, but rather as an introductory remark to distance his persona from the shadow of his literary accomplishments.

Foliar theory itself has many components and his method will serve best as an example for the discussion at hand if a selectively truncated version of it is outlined. In short, the phrase "all is leaf" is crucial but does not say much alone. "All is leaf, and through this simplicity the greatest multiplicity is possible." … "a leaf that only sucks fluid under the earth we call the root; a leaf that spreads out from those fluids we call a bulb, an onion, for instance; a leaf that stretches out we call the stem…"[11] Goethe uses 'leaf' to refer to the entity that, through successive changes, takes on one developmental stage after another until it finally differentiates into some particular role in the overall morphology. The final function does not stop it from being a leaf but constitutes the contexted situation of the leaf within external demands and within the needs of internal development. 'Leaf' does not quite successfully describe what he is trying to say as "the word 'leaf' is inseparably associated in daily usage with the foliage leaf, whereas, on his view, the foliage leaf has no more claim to be itself the typical 'leaf' than has, for

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9 See for instance Enrico Coen, *The Art of Genes: How Organisms Make Themselves* (Oxford, England: Oxford University Press, 1999).

10 Stephen J. Gould, *The Structure of Evolutionary Theory,* (Cambridge, MA: Harvard University Press, 2002). See in particular pp 281-291 and 1092-1095

11 Johann Wolfgang von Goethe, *Die Schriften zur Naturwissenschaft,* ed. Dorothea Kuhn, 21 vols. (Wimar: Hermann Bohlaus Nachfolger, 1977), 2.9a:58.

instance, the cotyledon or the stamen."[12] Following the leaf through metamorphosis is part of the work that he attempted to undertake. 'Metamorphosis' for Goethe is a description of a lawful process that guides the unfolding transformation of a plant throughout development.[13]

Goethe divided the workings of 'Metamorphoses' into two processes, intensification and polarity. Intensification could be recast in contemporary discussions as amplification within the bounds of historical constraints. Intensification is a push "toward greater complexity or perfection, toward the fullest possible expression in physical, empirical phenomena of the potential inherent in the underlying idea or *Urphenomen.*"[14] Polarity is described as the interaction of opposites, the pushes and pulls on parts of the organism. Limited resources and time are examples of this. Goethe meant by this the processes of expansion and subtraction that take place throughout the plant during development and through all changes in morphology during the life-cycle, inclusive of the production of flower, fruit and seed. One consequence of this push and pull is selection for adaptation to the external conditions: "The animal is formed by circumstances: this explains the inner perfection and its expediency with regard to external conditions."[15]

Goethe's writings often focused on the identification of a generalized supra-structure on which all organisms were based, but also gave significant strength to

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12 Agnes Arber, *The Mind and The Eye: A study of the biologist's standpoint* (Cambridge, England: Cambridge University Press, 1954), 75.

13 The origin of this process is the subject of the chapter on Charles Sanders Peirce.

14 Miller in introduction to *The Metamorphosis of Plants*, xix.

15 Johann Wolfgang von Goethe, "Morphologie Beitrage zur Optik," in *Werke* (Stuttgart: J.G. Cotta, 1840), Vol. 36, 281.

context in order to develop his explanation of change. Gordon Miller in his excellent introduction to Goethe's 1790 *Metamorphosis of Plants* notes that Goethe considers the interchange between "the law of inner nature, whereby the plant has been constituted" and "the law of environment, whereby the plant has been modified." This give and take of innate workings and contextual pressures shapes the developing individual "from within toward without" and "from without toward within."[16] The developing organism is not in the process of completing any sort of a pre-determined end, he only suggests that including all directions of influence will provide us with a more complete viewpoint in hopes that we might "attain a more satisfactory insight into the mysterious architecture of the formative process" if we study "how nature expresses itself from all quarters and in all directions as it goes about its work of creation."[17]

Agnes Arber has been one of the most successful proponents and students of the Goethian view of plants. Her *partial shoot theory* has been highly influential in botanical research, and dovetails with both Goethe's "all is leaf", and many of the calls for subjective awareness within his work. She also shares with Goethe wariness towards the reductionist project:

> The value of continually advancing technique is inestimable, so long as it is not allowed to become an end in itself, and thus to foster delusive industry of a pointless kind. The mechanical pleasure, for example, of cutting endless microtome sections, may lull the mind into serene inaction and comfortable passivity in regard to the problem to be solved.[18]

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16 Johann Wolfgang von Goethe, *Goethe's Botanical Writings*, trans. Bertha Mueller (Honolulu: University Press of Hawaii, 1952, Reprint Ox Bow Press, 1989).

17 Johann Wolgang von Goethe, "Toward a General Comparative Theory," in *Scientific Studies,* ed. and trans Douglas Miller (New York: Suhrkamp, 1988), 55.

18 Arber, *The Mind and The Eye: A study of the biologist's standpoint*, 54.

Kirchoff discusses Agnes Arber's theory whereby she sees the leaf and the shoot not as separate entities but as components of a whole. The whole is only broken down by the reductionist human mind in a hermeneutical attempt to understand, the mistake is made when the imagined piece-meal idea is mistaken for the reality of the unified object. As it exists in reality it is not a shoot and then a leaf but all parts are from the same consistent thing.

> [Arber] sees the intrinsic relation not as a static form, but as a dynamic relationship between the part and the whole. [Arber] is not searching for a better way to describe plant form, but for a better way to see what is already visible.[19]

Perhaps one of the greatest metaphysical assumptions still at play in contemporary reductionism is the role that the human mind and intellect plays in the formation of our ideas. Goethe's empiricism is influenced by his idealist predecessors and leads him to be more delicate in his subject/object dichotomy. Consequently, he leaves legitimate room for imagination when contemplating external objects and relations. Following in the definitive critical wake of Kant, Goethe is all too aware of the pitfalls of metaphysical thinking and makes a concrete attempt to ground the forward thinking of the human imagination within congruent empirical examples in botany.

John Dewey's concept of 'tendencies already present,' Peirce's constraints as a result of habit-taking, and Schopenhauer's instinctual drive for life creation have a direct connection between both Goethe's "all is leaf" and Arber's own thoughts regarding the idea innate tendencies and the resulting growth of the plant. In Arber's words:

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19 B.K. Kirchoff, "Character description in phylogenetic analysis: insights from Agnes Arber's concept of the plant," *Annals of Botany* 88 (2001): 1203-1214, at 1204.

> [T]he leaf is a partial-shoot, revealing an inherent urge towards becoming a whole shoot, but never actually attaining this goal, since radial symmetry and the capacity for apical growth suffer inhibition.[20]

Arbor is helpful as a reminder that the organism's real place in nature is different from its artificial place in our conceptualizations, and yet these artificial conceptions are integral to the work of Science proper. Dewey can be seen as emphasizing the interconnectedness of surroundings and organism, where as Goethe, and Arbor by extension, are emphasizing the interconnectedness within the growth and development of one organism. Schopenhauer's contribution is in giving identity to upward surging life force and Peirce explains how channels of habits arise from initially random events. In all of the figures under study the Kantian warning about the unknowability about some subjects of metaphysics is taken seriously. There is no certainty about the telos of any biological force. Yet, in each of the thinkers under investigation there is a weaker notion of teleology that does not crowd out the wonder of the empirical experience of nature, the radical change and diversity available through evolution, and that places an emphasis on continuity rather than the mining of separated parts.

Crucial to articulating Goethe's viewpoint is an understanding of his use of ther term morphology. Morphology is a familiar term in contemporary biology, but was a term that Goethe had to invent to capture the temporal interaction between organism and environment. Goethe is credited for coining the term morphology[21], but much of the practice of morphology for him consisted in the reconstruction of an ideal supra

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20 Agnes Arber, *The Natural Philosophy of the Plant Form* (New York: Cambridge University Press, 2012), 133. Originally published in 1950.

21 See Wilhelm Troll, *Goethes Morphologische Schriften* (Jena: E. Diederichs,1926).

organism that contains, and by extension, shapes organisms of a certain type. This attempt to see within related organisms a universal connection is one of the metaphysical aspects of Goethian morphology that has had a difficult relationship to contemporary evolutionary theory. And yet it is relevant to the discussion at hand as Miller contends:

> Because supersensible archetypes or objective ideas in nature are not things recognized by mainstream modern science, many have been led to reject Goethe's scientific approach as suffering too much from the romantic musings of his poetic genius. But to aim this criticism at Goethe's way of science is merely to beg the question he was posing about the limits of mainstream science: Can a mechanistic, materialistic approach that focuses only on innumerable individual surface structures meet the explanatory challenge of the living organism or the life of nature as a whole? His sense that the world we experience could never be built up from mere matter in motion, nor truly known on the model of a human subject confronting a mere object, spurred him to develop his alternative approach.[22]

The way in which this original conception of morphology was studied is extremely relevant to our discussion as it does not proceed from reduced parts to unified whole but begins with interpretation of the human perception of a unified organism. Arber contrasts morphological analysis with the reductionist methods of sciences:

> Though this may be true of physics and chemistry and of those phases of biological study in which physico-chemical methods predominate, it does not, for example, indicate adequately the goal of pure morphology, which might be describes as *the visual and conceptual interpretation of the perceived,* rather than *as the conceptual prediction of the unperceived*.[23]

Morphology as a term can thus be understood as the *construction of a contemplative type* and as an approach that understands the parts in light of their function and place in the whole. The consequence, as Arber describes it, is that

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22 Miller in introduction to *The Metamorphosis of Plants*, xxiii.
23 Agnes Arber, *The Mind and The Eye: A study of the biologist's standpoint*, 125.

> Problems of pure morphology cannot be solved by the methods of analytical science, the contemplative treatment of comparative form, rather than its analysis the standpoint of cause and effect, becomes the morphologist's aim; he desires to see form, both with the bodily eye and with the mind's eye, not only in itself, but in its nexus of relations. This process of mental visualization differs essentially from the thought-techniques of the physico-chemical disciplines. The morphologist's standpoint is set midway between that of the mechanistic sciences and of the arts, so that his work should offer a synthesis of intellectualist logic and sensory apprehension.[24]

An appreciation of Goethe's viewpoint requires looking at how he considered his ideas to be directly related to giving a scientific explanation of change in nature. The term that Goethe used for explanation of cause and effect relationship is 'Darstellung', which Arbor defines as "the demonstration or representation of an object, brought into relation with others in such a way that its significance is revealed"[25] Goethe's hope for understanding does not rest on belief in the method that proceeds analytically to define and separate from one another the individual parts. Instead he rejects that approach and instead places the hope of understanding on the ability to perceive all of the relational forces.

There were some fairly serious compromises to the overall legitimacy of Goethe's theory that came as a result of the implications of his morphology and the metaphysical assumptions behind the 'all is leaf' contention. He was in many ways too defiant of any reductionist understanding and overemphasized the holistic view of Nature in his morphological work. When genetic challenges were given to his attempt to provide a *type* for all fish or plants much of his empirical work lost a place to stand. Arbor describes it the downfall in more heroic language:

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24 ibid, 125.
25 ibid, 85.

> [H]e reached a stage in which his morphological thought reached out to the reconciliation of the antithesis between the senses and the intellect, an antithesis with which traditional science does not attempt to cope...Goethe was a great biologist, who, in the long run, overstepped the bounds of science.[26]

Despite the loss of legitimacy for his research, we can still take the morphological *type* as merely a heuristic device, like an atom, a molecule, and of course a gene. In doing so the concepts of both "all is leaf" and Goethe's morphology as he conceived it can have a useful place. Also, his brave attempt to include the boundaries and limitations of the human intellect in his construction of Nature is a modesty that is much more rare than the realism found embedded in many specialized discussions. Goethe's perspective is aware of the fragility of its current paradigm and open to readjustments of the way that the mind conceives of its perceptual subject. It is because of this aspect of his work that his overstepping of the bounds of science needs to be reinserted into the contemporary discussion. At one point, it was an overstep, but the method employed in doing so, as well as the identity of a unified nature he found on the other side of the line, are sorely needed given the extremes to which reductionism has gone and the parts that have been lost due to the disconnecting of relations between the life-cycle of the organism.

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26 Agnes Arber, "Goethe's Botany," *Chronica Botanica* 10:2 (1946): 63-126, plates 23-26, at 86.

# CHAPTER III

# BEHIND THE CURTAIN IS A WILD ANIMAL:

# SHOPENHAUER'S WORLD-WILL IN NATURE

Music shows us just what the will is, - eternally moving, striving, changing, flying, struggling, wandering, returning to itself, and then beginning afresh, -- all with no deeper purpose than just life in all its endlessness, motion, onward-flying, conflict, fullness of power, even though that shall mean fullness of sorrow and anguish. Music never rests, never is content; repeats its conflicts and wanderings over and over; leads them up, indeed, to mighty climaxes, but is great and strong never by virtue of abstract ideas, but only by the might of the will that it embodies. Listen to these cries and strivings, to this infinite wealth of flowing passion, to this infinite restlessness, and then reflect – *That art Thou*; just unreposing vigor, longing majesty, and – caprice.

-Josiah Royce[27]

## Introduction

The American philosopher Josiah Royce begins an 1892 lecture by noting that Arthur Schopenhauer is "better known to most general readers, in our day than any other philosopher other than Kant.[28]" This is certainly not the case today as most are unfamiliar with even the basic components of his metaphysics, sensationalist pessimism, and the centerpiece of his philosophy, his notion of the Will. This might be a result of both the difficulty and the first glance fragility of his position. A.O. Lovejoy wrote in 1910 that "The Absolute of the philosophy of Schopenhauer is notoriously one of the

27 Josiah Royce, *The Spirit of Modern Philosophy: an essay in the form of lectures* (Boston, MA: Houghton Mifflin Company, 1892), 256.
28 Royce, *Spirit of Modern Philosophy*, 228.

most complicated of all known products of metaphysical synthesis.[29]" Couple the difficulty of his position with what many of the leading Schopenhauer scholars of our own time consider to be a metaphysical system that does not hold together and is often inconsistent. The situation is further muddled because the concept of *willing* has a long intellectual tradition that is completely separate from Schopenhauer's use of the term. Janaway notes that:

> For in the history of the concept of will, Schopenhauer's intervention is idiosyncratic and perturbing. He does not simply take a pre-existing conception and give it an unwonted importance; he takes the word *Wille* and proposes for it a use that is revolutionary and far from straightforward.[30]

It is precisely this "idiosyncratic…perturbing…revolutionary" idea that has fallen out of such favor since Royce gave his lectures, and which, this essay contends, is in desperate need of another look and a re-envisioning in light of contemporary developments within biology and evolutionary theory. The task at hand is not a simple one, not only because the idea of the Will is "idiosyncratic," but also because of the fact that it is "perturbing."

The concept of the Will is challenging both philosophically as well as to our preconceptions about what it is to be alive in the most fundamental sense. However, despite the above statement from Janaway, I do not think that it is philosophically flimsy in the least, and to disregard it because it does not pass a criterion of judgment that it was explicitly trying to undermine is missing the message. Schopenhauer's eyes were open in a way that contemporary biology is not, and he presents a hard, honest, and powerful

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29 Arthur O. Lovejoy, "Schopenhauer as an Evolutionist," *The Monist* 21:2 (1911): 195-222, at 195.
30 Chistopher Janaway, "Will and Nature," in *The Cambridge Companion to Schopenhauer,* ed. Christopher Janaway (New York: Cambridge University Press, 1999), 138-170, at 138.

view of nature that is of great value despite its difficulties. These introductory remarks are not meant to inspire any sort of Schopenhauerian pessimism about the study of his concept of the Will. Rather, they are intended to pave the way for an application of his concepts and as an explanation for the historical and theoretical backdrop that occupies the next section.

This chapter pushes both into the historical influences behind the concept of the Will as well as moving it forward by situating it as a viable component of contemporary and future discussions of biology and the natural world. The starting point of the discussion is Arthur Schopenhauer's philosophical influences, inclusive of Early Modern philosophy, Immanuel Kant, Plato and the Upanishads. The position that Schopenhauer develops is so intricately tied up in the historical setting from which its development emerges that the understanding of Schopenhauer's Will that I would like to present can only be done after it is placed in this context. To further make the point that Schopenhauer's position is difficult to understand in isolation, it might be helpful to quote at length a section from A.O. Lovejoy's 1911 article:

> The Will is, in the first place, the Kantian "thing-in-itself," the residuum which is left after the object of knowledge has been robbed of all of the "subjective" forms of time and space and relatedness…The Will is, again, the "Nature" of Goethe; it is the "vital force" of the late eighteenth and really nineteenth century vitalists in biology; and it is even the physical body of man and animals, in contrast with the mind. It is likewise the absolutely alogical element in reality, the "non-rational residuum," of the last period of Schelling's philosophy; and it is an apotheosis of that instinctive, naïve, spontaneous, unreflective element in human nature, which had been glorified by Rousseau and, in certain of his moods, by Herder. It is Spinoza's "striving of each thing *in suo esse perseverare*." It is the insatiable thirst for continued existence which the Buddhist psychology conceives as the ultimate power that keeps the wheel of

> existence in motion, and it is an hypostasis of the Nirvana in which Buddhism conceives that thirst to be extinguished.[31]

The thesis here is not that Schopenhauer got it completely right; in fact, many aspects of his own application of the concept of the Will are disregarded for good reason.[32] Despite these flaws in his opinions and person, many of the justifications given for dismissing his philosophy have been disingenuous and come at the cost of the value of the heart of his theory. Although the view of nature that is being presented has a Schopenhauerian bent, it is not meant as an apologetic. The aim is to provide a thematic version of Schopenhauer that is useful in its application to biological theory but that intentionally avoids the problematic application to the human condition. I find Schopenhauer the least convincing when he does so, and find the concept of the Will most helpful for the explanation of behavior that we have no personal experience of, namely, animal behavior.

## *Arthur Schopenhauer*

Before directly addressing the philosophical backdrop of the Will, it might be helpful to provide introductory remarks regarding Schopenhauer himself and the primary concept. Schopenhauer claims to have a unifying strand that was consistently represented in everything he ever wrote regardless of the topic under discussion or whether he wrote it in his youth or near his death. The confidence that he had in the

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31 Lovejoy, *Schopenhauer as an Evolutionist,* 195.

32 Particularly his views on woman, his inconsistency on the fixity of species, his occasional remarks on the hierarchy of living things, among other claims that cannot be written off as products of his historical situation.

consistency of his work led him to ask that those who were trying to understand the entirety of this unified Idea should read everything he ever wrote: "In general, I make the demand that whoever wishes to make himself acquainted with my philosophy shall read every line of me.[33]" Not only did he want the reader to avoid summaries of his work, but his confidence in the unity and depth of the idea led him to go further in his demands on the reader by saying: "In order that the thought expounded may be fathomed, no advice can be given other than *to read the book twice*…[34]"

This sort of a claim, which borders on hubris, is indicative of his person. That being said, the message of this demand is not entirely unfounded or hyperbolic. The heart of Schopenhauer's at times desperate pleas for recognition is the belief that the more one makes connections between his concept of the World-Will and the wider realm of experience the clearer the idea is understood. He is demanding intensive and repeated exposure to his one-unifying-idea to include not only reading more of his writings on the subject, but to apply the concept *into* the experience of the world around us. It is a call for immersion and for practicing seeing the World through the eyes of the Will. He does so with confidence that the idea holds universally and that no contradictions can be found. A primary contention of this chapter is that his idea of the Will is indeed illuminating and helpful.[35]

The influence of his idea of Will on the spirit and worldview is indicated by those who took it seriously and either adopted or rejected his position, including,

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33 Arthur Schopenhauer, *The World as Will and Representation*, trans. E.F.J. Payne, 2 vols. (New York: Dover Books, 1969), Vol. 2, 461.

34 Schopenhauer, *The World as Will and Representation,* Vol. 1, xiii.

35 Less compelling is his extension of the World-Will to concepts of physics and chemistry and consequently the following will restrict the extension of his idea to the biological world.

Darwin, Jung, Wittgenstein, Nietzsche, Wagner, Tolstoy, Royce and Einstein among others. Many have claimed that they have been influenced by Schopenhauer, and yet there are very few actual Schopenhauerians. This can be explained in part by discussing the different relationship between Schopenhauer and those that are marked by his thought, and other schools such as Neo-Kantians, Neo-Platonists and their relationship with their touchstone philosophers. There is something objectionable and 'perturbing' in Schopenhauer's writings and turns of reason, which tends to convert even his closest readers against him. Schopenhauerians that have been inspired by their revolt against him consist of a varied but passionate group. Although, even in the cases where parts of his metaphysics are held with vigor, other parts are often rebelled against as being non-negotiable and unacceptable. Tolstoy's *Confession*, Wagner's *Tristan and Isolde*, and Nietzsche's concept of Dionysius all have direct ties to struggles with Schopenhauer's metaphysics and are also all characterized by a violent upward turn out of Schopenhauer's system so as to escape the dire consequences it implies. Even current Schopenhauer scholars such as David Cartwright, Julian Young, and Christopher Janaway do not think that he successfully described his idea. That being said, the continual lingering on of Schopenhauer as a borderline figure in an extremely diverse group of subjects is testament to the strength of his thought. The inability of his work to gain acceptance as a legitimate position was frustrating to Schopenhauer during much his lifetime and may be the result of his broad and difficult metaphysical idea, or as suggested here, as result of the consequences of his position that many find unacceptable.

*Introduction to the World-Will*

Despite a slight incredulity about the claimed success of his task, the insight of his unifying idea, the World-Will, is extremely valuable in many situations at providing meaning and explanation that crosses otherwise impossible epistemological limits – even if only hermeneutically. Any reading of Schopenhauer's work gives a clear indication that the philosopher himself carried this Idea into all corners of his interpretation of the world and applied it to an increasingly widening circle of human knowledge. To paraphrase Heidegger, every philosopher only has one real idea, they then spend their life just trying to say it right. This takes on an interesting twist for Schopenhauer, whose amazement at the lack of initial recognition of his one great thought led him to continue to point to examples in nature that 'were saying it right' on his behalf.

Schopenhauer's unifying Idea was seen by him in all facets of life, human, animal, physical, chemical, moral, aesthetic. Schopenhauer's concept of the Will is a basic idea in that it has a single identity, but yet is also complex and multi-faceted idea in its expression. He set out to make a collection examples showing how the various incarnation of his idea were exemplified by the scientific work of his time. In this essay we take up a similar, but more focused, project and show how Schopenhauer's World-Will helps to provide a tool to investigate discussions about evolutionary theory that were not on the table during his lifetime, but which, nevertheless, can be aided by the insight of a Schopenhauerian metaphysics. In short, his unifying idea contends that all living and nonliving things are motivated by a universal force, namely, the Will or World-Will or Will to Life in the organic realm. Although Schopenhauer thought that

his concept of the Will was a truly universal metaphysics, in that it could explain all aspects of our experience of the world, we will not be focusing on his work on the inorganic. For instance, his description of gravity as being an objectification of this same wanting force is interesting but it may only muddle the otherwise salient evolutionary view of nature that his organic philosophy presents.[36]

### *Connections to Ecological Sensibility*

Within the realm of living things, there are a multitude of ways in which Schopenhauer has implications for the larger themes of this dissertation. The first is the hermeneutic value of seeing nature as a unified force that does not offer hope for explanation only after the last piece has been dissected. On his system nature is a single motion of selfish sentiment that emerges and is embodied in the actions of trillions of individuals. Instead of trying to label the identities of each of those trillions of individuals he instead turns our eye to the nature of selfishness itself and contends that it is prior to, and more fundamental than, the individuals that express the selfish tendencies. This allows us to ask questions about the entirety of nature with the intent of deriving generalizations and laws.[37] Also, within the contentious and often misguided discussions of the *purpose* of nature and the *motivation* of animal behavior there are many clear examples where Schopenhauer helps explain a phenomenon in a way that is

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36 Similar treatment is given to Peirce's concept of 'evolutionary love' in the final chapter. Both concepts run parallel to the primary ideas, but because they are not applied to the organic they fall outside of the scope of this work.

37 See Chapter four's discussion of Nancy Cartwright for further discussion of laws of this sort. Schopenhauer is not linked with Cartwright's position, but there is a similar notion of the generalization of emergent and functional laws at work.

enlightening and might be helpful for contemporary discussions. The Will is teleological in that it has a purpose, namely reproduction, but it is blind and aimless in that it goes wherever it can to accomplish this goal and does not plan ahead or require the postulation of anything resembling a divinity with knowledge of the future.

Schopenhauer's depiction of nature provides explanatory and insightful assessments of contemporary philosophy of biology debates over sexual selection, the definition of a species, group selection, parasite ecology, social evolution and adaptation. Schopenhauer's contribution to these questions sets the stage for the next chapter's discussion of explanations of evolutionary change and introduces examples that are carried throughout this dissertation. Direct connections to John Dewey's concept of growth will serve as the transition to the next chapter, which features Dewey's concept as the centerpiece.

Given the complete immersion demanded by Schopenhauer it is necessary to acknowledge that this chapter will only attempt to digest a few examples in which his insight is elucidating. The hope being that the presentation of Schopenhauer's idea will be such that it can be applied outside of these examples without prompting. The initiating questions that arise out of wonder about the natural world are the same for Schopenhauer as they are for us today. The questions that are going to be addressed are explanations of behavior inspired by wondering as to the reasons, purpose, and intentions of seemingly orchestrated and innate actions in living things. Whether it be fish, birds or insect, there is a set of questions for which Schopenhauer's metaphysics provides immediate and useful explanation that is impossible to capture by almost all

other methods of explaining behavior. It is a method that might be classified as extra-scientific to some, but to Schopenhauer was not a method at all but an insight into two necessities. First, the byproducts of human understanding as a result of Kantian structures of the mind, and second, a law of existence that states that in order for life to continue to be, it must have *continued-being* as its primary and fundamental purpose.

## Section One:

## Frameworks for Interpreting the Unknown

One way to define philosophy as a whole is to say that it is a reckoning with the limitations of our access to knowledge. In the vein of Plato and Kant, Schopenhauer holds that it is something like sophistry to claim to have access to things beyond our limits, and that it is the task of a philosopher to define the boundaries of the beginning and end or those limitations, as well as to try and understand why and in what way they are limited. In other words, what can we know and how? This is one way to ask the question, another is to ask what remains unknown and why does it remain so. This section explores a version of the Early Modern development of thinking about the unknown that takes a drastic turn when put in the context of Schopenhauer's concept of the Will. The unknown is a broad concept that is called many things, including, Thing-in-itself, the noumenon, the substratum, the un-sensed and insensible material world, the world behind the world, and for Locke, the I-know-not-what. Schopenhauer offers an explanation for how we might interpret this unknown that is more Darwinian than it is hopeful. It is a method of understanding the unknown that sets up a counterweight to

Early Modern depictions and also provides a valuable tool for contemporary hunches about the unknowns of nature.

I would like to make it clear that this historical survey is a landscape that will be followed by a focused application. A consequence of such a survey is that the landscape is broad and concepts that deserve a dissertation to themselves are presented only as guideposts leaving many of the main problems discussed on the wayside. This broad landscape is then placed in the relatively telescoped discussion of Schopenhauer 'single thought.' The following background is essential to understand the modifications made by Schopenhauer to Kant's epistemological turn on the Early Modern notion of the 'thing in itself.'

The central problems of this discussion all start in Descartes. To put it bluntly and quickly, the separation of phenomenon and noumenon associated with Kant is a byproduct of the problems created by the epistemological limitations and consequences of Descartes two substances, mind and body. In each of the thinkers we will look at closely in this section, Descartes, Locke, Kant, and then Schopenhauer, there is a collection of evidence followed by an informed guess about what is there beyond the reach of collectable evidence. The interaction between the known and the unknown is by definition fuzzy, illusive and difficult, and all statements about it are, by definition, not knowable. Interestingly, each of these thinkers say that it is impossible to talk about the unknown and then go on to say something very specific about what it is. For Descartes it is the connection between the causal relation of mind and body as found in the pineal gland. For Locke it was referring to the unknown as the "I know not what,"

but then saying that we can be somewhat confident that we have weak knowledge of it. For Kant it was "the starry heavens above and the moral law within" that give evidence testifying about the positive disposition of that which is beyond our empirical limitations. In defense of each of their reaches, we could say that there is a distinction between claiming that it is unknown, or insensible directly, and then still saying something about its nature. To understand Schopenhauer's venture into the unknown we will look at the natural world itself for examples, inclusive of those outside of Schopenhauer's knowledge base in order to see if the concept still holds explanatory power.

### *Physics versus Biology*

One way to differentiate amongst these thinkers is through the problems that they worked on and the scientific fields that were under revolution and in need of a philosophical eye at the time of their writing. Seen this way, the Early Modern concerns are primarily directed at physics, whereas later developments shift more towards biological concerns. Early Modern thinkers were trying to incorporate into their philosophical worldview the Humanistic Renaissance, the astronomy of Copernicus and Galileo, and the scientific method and its discoveries as found in Bacon and Newton.[38] One consequence is that there is an assumption that all of the material world, the world

38 I am thinking here of Leibniz's thoughts about alien life upon contemplating that each star is a sun potentially just like ours.

as it is, is a rational world governed by deterministic laws and subject to the principle of sufficient reason.[39]

On the Newtonian model, the unknown operates under certain principles constricted by necessary conditions and predictable by a trial and error investigation of its limits and tendencies. The fervor over the potential to discover the previously hidden truths of reality led to a carving out of subject matter that was considered acceptable for philosophical and scientific investigations.[40] Take for instance the limiting of scope by Descartes:

> We should busy ourselves with no object about which we cannot attain a certainty equal to that of the demonstrations of Arithmetic and Geometry" and "Our inquiries should be directed to what we can clearly and perspicuously behold and with certainty deduce: for knowledge is not won in any other way.[41]

Coupled with John Locke's hope expressed below we can see a desire for conclusive explanation of the natural world that is identical to explanations of the laws of physics:

> I doubt not but if we could discover the figure, size, texture, and motion of the minute constituent parts of any two bodies, we should know without trial several of their operations one upon another, as we do now the properties of a square, or a triangle. Did we know the mechanical affections of the particules of *rhubarb, hemlock, opium,* and a *man*,… we should be able to tell before hand, that *rhubarb* will purge, *hemlock* kill, and *opium* make a man sleep.[42]

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39 The Principle of Sufficient Reason is directly critiqued in the chapter on Peirce's metaphysics and his concept of absolute chance.

40 Similar narrowing of scope can be attributed to the positivists and their condemnation of late Wittgenstein for not being early Wittgenstein. Thomas Kuhn's work in the philosophy of science still remains the most helpful explanation of how scientific revolutions get going by adopting certain terms and areas of investigation that eventually collapse under the dialectical revelations of the limits of those assumptions and methods.

41 René Descartes, *Rules for the Direction of the Mind*, ed. Errol E. Harris (South Bend, IN: St. Augustine's Press, 1997), II and III respectively.

42 John Locke, *An Essay Concerning Human Understanding,* ed. Roger Woolhouse (New York: Penguin, 1998), IV, iii, 25.

Even at the contentious demarcation of the end of the Early Modern period, Kant's Second Critique, we can see Kant holding onto this enlightenment vision of certainty when he contends that morality is able to be broken down to arithmetic-like principles of deduction.

On the other side we can see Kant in the Third Critique, the *Naturphilosophen* movement, and Schopenhauer Late Modern, addressing the need to explain and understand the bubbling up of a different Copernican moment, a revolutionary biological theory, namely evolutionary theory. Schopenhauer is an ideal model study in this regard. In between his first and second editions of his magnum opus he adopted a sort of evolutionism due to shifts in the scientific worldview of his time. By 1850, almost a decade before Darwin published *The Origin of Species*,[43] he had reformulated his philosophy of nature to include evolutionary concepts.

The difference between the two worldviews is drastic as the explanations of behavior inspired by celestial bodies and the movement of physical objects is a much different question than the explanation of the behavior of biological life, with all of its messy and imprecise mistakes. If you start with completely abstract mathematical notions and apply it to the biological world there are remainders. The alternate, applying empirical evidence of change in nature to physical objects and celestial bodies you perhaps do not get remainders, but you also don't get concrete generalizations. For instance, we do not think of the objects that are the study of astronomy as prone to

[43] Originally titled *On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life* in 1859 and changed to *The Origin of Species* in the sixth edition published in 1872.

making mistakes. Even if they were to collide, explode or form black holes. Yet when looking at the biological world, we have no problem claiming that non-human biological life is maybe making a mistake, for example, if it were to die, or do something that was not in the best interest of the individual or the species. Stars, planets, black holes and objects of mass moving at an estimable rate of acceleration do not have interests in the same way as birds seeking nests, slime seeking resources, or plants seeking sun. Schopenhauer is radical in the respect that he flips the paradigm and explains the motion of all objects, including the non-biological, as being explainable by the wants, desires, and interests of a metaphysical backdrop that is an organic, living, pulsating Will.

### *Personal Experience in Descartes*

For Descartes, Mind and Body are distinct substances and their interaction can only be explained by presupposing their interaction. This in short is the the mind/body problem. How do they interact? Is the relation direct, is it third party, is it an illusion? If you look at the history of epistemology since Descartes you see the recurring theme of needing to get from private experience to an external world. Descartes crosses that gap by using an idea of a good God that guarantees his power of reason. Locke, Berkeley, Hume, Mill, Russell, all feel compelled to address this question of how we get from personal experience to an external world. Instead of working from personal experience out to the external world, an alternative approach is to say that starting point should be the external world, this method can be roughly characterized as that of contemporary science.

When Descartes looks out his window and wonders as the internal workings of the minds of the people on the street below he worries that there are no minds there, and that they are automatons thinking and acting in a way that is entirely foreign to the way that he does. This moment of wondering about the ultimately unknowable inner workings of the mind of the 'other' is essentially what is going on when we ask how does the spider know how to spin such an intricate web, or how does the fish know what to do to attract a mate? In the spirit of Descartes question, we can ask whether or not they are automatons of instinct merely running out a program. The Meditations introduced, even if it was a rhetorical device, the idea that sense perception is not sufficient, by itself, to secure knowledge of the intentions and motivations of an external, material, living object.

In contrast to this method, Schopenhauer can be seen as undertaking a combination of both the external and internal strategies He claims: "My entire philosophy can be summarized in one expression: The world is the self-knowledge of the will.[44]" The will, is found everywhere expressed in all external objects. As a result, an investigation of one's self-knowledge as well as a study of other external expressions of the will constitutes his method of philosophical inquiry.

### *Innate Knowledge and Animal Instinct*

One strand that we can use to pull all of this together is the concept of innate ideas. Locke says that we have no innate idea of substance, particularly external

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44 Arthur Schopenhauer, *Manuscript Remains*, trans. E.F.J. Payne, 4 vols. (Oxford: Berg, 1988), Vol. 1, 512.

material substance, and so it is difficult to be certain about it. Descartes "clear and distinct" criteria for knowledge is only ascribed to external material substance through a great deal of work that runs through various proofs for the existence of God and through faith in the power of reason. Despite their differences on this issue, both Locke and Descartes contend that immediately intuited knowledge does not require an argument. For instance, the knowledge of our self, knowledge of one's own existence for Descartes:

> [I]*ntuition* is the undoubting conception of an unclouded and attentive mind…Thus each individual can mentally have intuition of the fact that he exists, and that he thinks; that the triangle is bounded by three lines only, the sphere by a single superficies, and so on[45]

This is an echoing of a position that is more famously stated in the *Meditations* and the *Discourse on Method*. Descartes derives this conclusion from his own personal experience of the human mind. If we make the same sort of analysis of the unknown minds of organisms in the natural world what can we say? Schopenhauer contends that we have a way into an understanding of the animal mind, and it is presented with just as much certainty as Descartes thinks personal experience and the cogito gives to our intuitions and innate ideas:

> But the word *will*, which, like a magic word, is to reveal to us the innermost essence of everything in nature, by no means expresses an unknown quantity, something reached by inferences and syllogisms, but something known absolutely and immediately...[46]

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45 René Descartes, *Discourse on Method and Meditations*, trans. Laurence J. Lafleur (New York: The Liberal Arts Press, 1960), III.

46 Schopenhauer, *World as Will and Representation*, Vol. 1, 111.

What kind of intuitions does the spider or the fish have? Descartes here has nothing certain to say, whereas for Schopenhauer, it is the combination of our personal experience with the philosophical investigation of the universality of the substructure of the mind that allows us to create an analogy between our own experience and that of all other living things. Schopenhauer writes "Motivation is causality seen from within. The cornerstone of my whole metaphysics is entitled the "law of motivation.[47]" For Schopenhauer, it is the Will that allows us to formulate the causes of our innate ideas and intuitions. The Will is prior to knowledge and does not emerge out of the gathering of any knowledge. It is something like an innate idea, but as we will see soon, it looks also a lot like the concept of instinct. As the American philosopher, Josiah Royce describes it:

> My whole inner life is, namely, essentially my will. I long, I desire, I move, I act, I feel, I strive, I lament, I assert myself. The common name for all this is my will. By will, of course, Schopenhauer does not merely mean the highest form of my conscious choice, as some people do. He means simply the active nature of me, the wanting, longing self-asserting part. This, in truth, as even the romantic idealists felt, lies deeper than my intellect, is at the basis of all my seeing and knowing.[48]

The innate ideas of the human will be different from those of any other organism, the spider's innate idea of a web for instance, because the Will manifests itself differently in each organism based on the needs of that organism to continue the Will's work – namely reproduction and the creation of more Will.

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47 Arthur Schopenhauer, *On the Fourfold Root of the Principle of Sufficient Reason*, trans. E.F.J. Payne (La Salle, Ill: Open Court Press, 1974), 214.

48 Royce, *Spirit of Modern Philosophy,* 252. I owe considerable debt to Royce's writings on this subject. He is someone that personally struggled with Schopenhauer's views and the result is beautiful and insightful writing on the most challenging aspects of the Will.

> As in every form of animal the Will has equipped itself with every organ for offence or defence, so it has likewise provided an intellect as a means for the preservation of the individual and the species…Consequently the intellect is destined to serve the Will and is everywhere exactly adapted to it.[49]

The path that Schopenhauer takes to overcome Descartes problem of stretching personal experience to the Automaton of other minds, while allowing him to say something distinct and universal about Locke's I-know-not-what, travels through Kant.

> It is merely the dark background of the world of experience; it is the One which remains while the many change and pass. From the point of view of the world of the many and of change, it is literally nothing. To the understanding it is necessarily as inaccessible, and, indeed, as self-contradictory and meaningless, as is the Unknowable of Herbert Spencer, - of which it is, indeed, the twin brother, not to say the identical self. This kind of negative an inexpressible Absolute is a sufficiently familiar figure in the philosophy of all periods. Schopenhauer assuredly did nothing original in reviving it. What was original in his work was that he baptized this Absolute with a new, and startlingly inappropriate, name; and that he gave it this name because in spite of himself, he was really interested in quite another kind of "ultimate reality" of which the name was genuinely descriptive.[50]

In the context of the unknown that Schopenhauer's position emerged from the question centered on whether it was the mental or the physical that was the primary substance, Schopenhauer contended that it was actually something much more deeply rooted than either substance. Both substances, he contended, were mere representations of the final reality, which is neither mind or matter, but rather a force. This vitalistic force is neither mind in that it has no consciousness or intentionality, nor is it matter because matter is only gives it an outer shape, as clothing does the one that is clothed. Pushing past these

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49 Arthur Schopenhauer, "Vergleichende Anatomie," in *Sammtliche Werke,* ed. J. Frauenstadt, 6 vols. (Leipzig: Brockhaus, 1919), Vol. 4, 48.

50 Lovejoy, *Schopenhauer as an Evolutionist,* 197.

other attempts at positing the primary substance he looks to other sources to aid in explaining this force, his Will.

We will now conduct an analysis of the consequences of Schopenhauer's re-interpretation of Kantian metaphysics before completing the discussion of his philosophical influences and impressions by turning to Plato's Forms, the Upanishads, Brahman, and Early Indian Thought.

## Section Two:

## Influences on Schopenhauer's Metaphysics

### *Kant's Noumenon*

Schopenhauer only considered two philosophers to be something other than, in his words, "bags of hot air," they were, Plato and Kant. Plato's Forms had a role in shaping his concept of identity, species, and supported his realist conception of a world beyond our phenomenal experience. Kant provides the basis for his metaphysics of personal experience. Schopenhauer contended that his philosophy "is merely the perfection of Kantian transcendental idealism.[51]" This section has two main functions. The first is to provide an interpretation of the connection between Kantian and Schopenhauerian metaphysics. The difference is particularly revealing for the feature of Schopenhauer's position that is later placed into context of contemporary biological discussions. The second is to provide an interpretation of the Schopenahuerian position

51 Schopenhauer, *Gesammelte Briefe*, 284.

that makes possible an interpretation of the World-Will that avoids the problems as seen in Early Modern metaphysics and epistemology.

The unknown in Kant's philosophy, the thing in itself, is in Schopenhauer's system the one great unifying idea, the Will. The thing in itself had been mostly abandoned by his contemporaries, Fichte, Schelling, and most importantly Hegel who had turned Kant on his head saying that thing-in-itself is actually that which is the best and most immediately known thing - negation.[52] In Schopenhauer's initial edition of his dissertation, he is harshly critical of Kant, but over time became his champion when faced with the criticisms of Kant brought forth by his contemporaries. Schopenhauer wished to preserve the distinction between phenomena and noumenon that laid at the heart of Kant's metaphysics, although he did have very specific and drastic twists on these distinctions. His 1813 dissertation *On the Fourfold Root of the Principle of Sufficient Reason* contends that reality is actually a unified entity and that there are different angles and lenses upon which we view this reality making it appear as though there were distinct elements. He ultimately contends that his metaphysics is a version of the move made in Kant's own dissertation, which posits space and time as byproducts of the human mental condition. In the 1847 edition of Schopenhauer's dissertation, he added the following description of Kant's turn:

> As such, space and time are transcendentally ideal, because they are subjectively imposed frameworks in which we perceive the world. Yet space and time are empirically real, because we intuit them as if they were objective structures of experience, existing as it were, independent of our consciousness[53]

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52 Cartwright, *Schopenhauer: A Biography,* 305.

53 Schopenhauer, *On the Fourfold Root of the Principle of Sufficient Reason,* 45. He did not have this Kantian distinction in the original 1813 dissertation, but added it in the 1847 edition. The phrase "as if" is notably pragmatic – they are not 'real,' but we operate as if they were for pragmatic

Schopenhauer thought that by identifying the illusory nature of way that the human mind constructs experience we remove the abstractions that hide the true essence of the natural world. As Josiah Royce describes Schopenhauer's hope about what remains when removing these constructs: "[A]bstract space and time, with all their manifold and illusory distinctions of places and moments, and the real world collapses into one immanent nature of things."[54] Our perspective causes our phenomenal perceptions to be only representations of the underlying reality. Once removed Schopenhauer sees the identity of this underlying reality if viewed outside of space and time and away from other abstractions as the Will. This is a radical break from the Early Modern understanding of an external physical world and an internal mental world. On Schopenhauer's account, they are the same just seen from a different vantage point. Locke's guesswork about how knowledge is formed about the I-know-not-what and Descartes solipsistic problem of other minds is not an issue for Schopenhauer. So too does he think that his dissertation's main thesis is able to avoid the issues of phenomena and noumena as presented by Kant. "By adopting this perspective, Schopenhauer prided himself with avoiding the Achilles' heel of Kant's philosophy, having the thing in itself function as the cause or ground of appearances.[55]" The most immediate upshot of Schopenhauer's modification to Kantian metaphysics is that he believes that he is able to circumvent the limits of speculative reason that were at the heart of Kant's First Critique. The 'thing in itself' that emerges is drastically different than that envisioned by Kant. It

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reasons.

54 Royce, *Spirit of Modern Philosophy*, 251.

55 Cartwright, *Schopenhauer: A Biography,* 304.

is wild and irrational in a way that doesn't match up with the problems of traditional philosophy, but which does provide a theoretical model for the gesticulations of evolutionary change.

### *The Irrationality of the Will*

Kant, Aristotle and many philosophers have identified reason as being unique to humans and conclude that it is the essence of humanity. Schopenhauer does not place reason so far up the hierarchy of traits and considers it merely a behavior trait of humanity. This is largely because all things have the same essence under Schopenhauer's system, Will is everything's ultimate essence.[56] If Kant's system is constrained by the *human* synthetic a priori, then Schopenhauer's system has constraints on *nature's* synthetic a priori. They are much more simple than in the Kantian system, and even more egalitarian in that they are not restrained to human minds. We have (innate or instinctive) access to it through our own impulses, desires and wants, but also through observation of nature and human history.

The self-reflection of Kant's philosophy tells us only what is going on inside the rational mind because there is no special key for the universe if we figure out how 'reason' reasons. For Schopenhauer reason is just our special tool, as spinning a web might be for a spider, or hibernating in extreme temperature conditions might be for another organism. For Schopenhauer, it is a trait that has adapted in service of the cause

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56 "He also rejects the idea that because humans alone possess reason, humans alone are morally considerable. If a being can suffer, it is morally considerable, because preventing and relieving suffering is the hallmark of moral behavior." ibid, 304.

that all traits are developed – survival, reproduction, and the expansion of the Will. Josiah Royce describes it with powerful imagery:

> Will, merely as such, isn't precisely a rational thing; it's capricious. It wills because it does will; and if it wills in us all to be of such nature as to see just these stars and houses, then see them we must, and there is the end of it. …so that it embodies itself for us and in us as just this show-world, rather than any other, because such is its fashion of willing. [57]

In other words, the Will which is the primary undergirding essence of all living things, is not rational. It behaves consistently, but it does not consult reason in its motivations. Reason is not a primary aspect of the world at large, rather it comes about afterward, with humans, because it helps us to carry out the directives of the Will.[58]

The contention that rationality is not the essence of humanity is a huge blow to the idea that humans are special, at the center of the universe, and have a purpose that is not tied up with a singular purpose shared by the cockroach and the Ebola virus. There could be no greater separation between Kant and Schopenhauer than on this issue. Kant looks behind the curtain of perception and sees the "Starry heavens above and the Moral law within" and contends that it is reason that is the key to unlocking universal laws and truths about things outside of personal experience. Schopenhauer, on the other hand, looks behind the curtain and sees reason as only a morphological trait. And like the

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57 Royce, *A Spirit of Modern Philosophy*, 238-239.

58 There is a significant problem for Schopenhauer in this argument. The Fourfold Root upon which Schopenhauer rests his ability to access the identity of the Will itself is based on the principle of sufficient reason, and on a priori rational. There is something incongruous about the World-Will being irrational and yet ascribing laws, rules and behavior to it. Especially as these laws and rules of behavior are uncovered through an investigation that is confident of the necessity of its steps because they conform to reason. One solution to the criticism is that it is a specific meaning of the word rational. In the Kantian tradition, to be rational is to be free and moral, but to the contrary, the World-Will force is neither free nor bound by rules of right and wrong, its only creed is to move forward, to grow.

moth attracted to the flame, reason guarantees no success for the individual if trust is put in it only because it is instinctual.

This distinction is one that has often caused philosophers to rebel from Schopenhauer. There is the obvious problem that he uses reason to uncover a lack of specialness for reason. But, there is also the problem that it limits what we can do about it and belittles the human mind's capability to cross over to true knowledge, a hope that is often seen as fundamental to motivating philosophical and scientific investigation. I turn here again to a passage from Josiah Royce's work on Schopenhauer. Royce himself had a life-long struggle with Schopenhauer, which echoes the sentiment of Nietzsche's turn to existentialist rebellion and Tolstoy's turn to religion:

> Constructive idealists have always sought it in that common band of rationality which, as they conceive , so links us all together that we are organically related parts or moments of one deeper self…therefore we alike look out into the depths of space, where the same stars seem to glitter for us all. Unity, fixity, assurance, we get, if we get such prizes at all, only by virtue of that rational and spiritual unity that is beneath our lives. Can the philosopher find the true heart and essence of this our common selfhood? If he can, then idealism becomes a system…and our life has an organic fixity, a lawful completeness about it, such as every philosophy longs for.[59]

Kant and his moral law are, of course, what Royce is holding up as the idol of idealism. Schopenhauer is notable in this regard because of his 'irrationalism' and how this understanding of the 'thing in itself' also led to a complete system that produces an organic fixity of purpose. A fixity of purpose that is able to absorb and account for evolution through growth, death and destruction. "The universal reason builds the world, says idealism; but then does not the universal reason seem to build many

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59 Royce, *The Spirit of Modern Philosophy,* 235.

irrational facts into its world?"[60] Schopenhauer is almost alone in building this irrational component of life into his definition of the external world. In other words, there is no needed adjustment of our perception of the world to come into line with what is assumed to be a rational thing in itself. The world itself is irrational and no good reason exists to be found. Even if the fundamental structure of the human mind is egalitarian and rational, this does not extend to the external world.

> Yet this their basis can't be anything ultimately and universally rational. For in so far as we actually have reason in common, we think necessary, clearly coherent, exactly interrelated groups of ideas, such, for instance, as the multiplication table. But about the star clusters and the sea waves there is no such ultimate rational unity and coherency.[61]

At this point it is worth briefly discussing Schopenhauer's pessimism because it is intrinsically interwoven with his metaphysical understanding of nature that will be the focus of the concluding chapter. To the point, nature for Schopenhauer is not a kind loving force, rather, it is a brute power with a single focus, namely to reproduce more of itself. For Schopenhauer all living things are extensions, manifestations, or in his parlance objectifications, of the same living force. This force, Schopenhauer's Will or World-Will, is a rich test case for questions about teleology and purpose in that it is driven by a single program, growth of itself by any means necessary. The World-Will is both crudely blunt and destructive in the short term while also being inconceivably crafty in the long spaces of evolutionary time. All the while, being blind to its goal and driven solely on self-propagating instinct. There is no central brain like entity or intentional predesign. Schopenhauer's will is not an ideologue with principles applied to

60 ibid, 236.
61 ibid, 237.

a changing world, instead, Schopenhauer's Will is malleable, plastic, pragmatic, functional and (when placed within the framework of large expanses of time) resembles something very similar to Darwinian evolution. So, when philosophers peak behind the curtain of our knowable perceptions, they see many things. Descartes sees an all good God that guarantees the fidelity of our perceptions, Kant sees an ordered universe and universal morality, Schopenhauer, sees a Wild Animal. Schopenhauer is often derided as being a pessimist for this part of his view of nature, he contends he is only being honest and not viewing the world through reason colored lenses.

### *Platonic Forms*

The two other influences that played the greatest role in shaping Schopenhauer's philosophy of nature are Plato and Early Indian Thought. Both are crucial to the identity of the Will. Schopenhauer calls upon Plato in his attempt to portray the Will as a fixed and final thing outside of time and space and already perfected in its essence. "Each individual being is in some degree different from every other, and the name of them is legion. But the generic forms, the kinds of individuals that there may be, are determined by the natures of the Ideas.[62]"

In regard to the classic critique of Plato offered by Aristotle whereby the interaction between the Form and the differentiated things of the world of becoming, Schopenhauer already has his answer as found in the response to the Early Modern problem as discussed above. To repeat, there is no need to explain the interaction

62 Lovejoy, "Schopenhauer as Evolutionist," 200.

because they are different sides of the same coin, there is no causal interaction between them, they are an identical object viewed from a different angle. Humans appear as individuated objects existing in space and time because that is the perspective that best allows us to continue the pursuit of the continuation of the Will. The world of representation is in time and spreads out, the other side of reality is as immutable as a Platonic Form. Schopenhauer includes species here. "[N]ow I say that these *grades of the objectification of the will* are nothing but Plato's Ideas.[63]" Species are subcategories, able to be changed and move according to the representational needs of the Will. Cartwright notes that "These particular are always coming to be and perishing. Schopenhauer contended that these fixed grades of the will's objectification are related to particular things as eternal forms or archetypes.[64]"

Placing Schopenhauer's depiction of nature on the Platonic scale, we could say that the individuals of any species were the copies, the species the Forms, and the Form of the Good is the Will itself. The Will is that which would still be here even if we were here, or whether there was any intelligence or thing that had interests at all. It is primary, but takes on various forms.

> The will has certain ultimate fashions of expressing itself, certain stages of self-objectification, as Schopenhauer calls them. These, in so for as contemplation can seize them, are the ultimate types, the Platonic ideas, of things, all endlessly exemplified in space and time by individual objects but, as types, eternal, time-transcending, immortal. They are the ultimate embodiments of passion, the eternal forms of longing that exist in our world.[65]

63 Schopenhauer, *World as Will and Representation,* Vol. 1, 129.
64 Cartwright, *Schopenhauer: A Biography,* 309.
65 Royce, *The Spirit of Modern Philosophy,* 256.

Just as the more we know what makes a Good flute tells us what a flute is, so too knowing what the World-Will is allows us to know what motivates the spider and the fish. The process goes both ways, studying the individual reveals aspects of the universal, knowing aspects of the universal allows one to interpret the behavior of previously unknown motivations of the individual.

> [T]he idea is only the immediate, and therefore adequate, objectivity of the thing in itself, which is *will* – will insofar as it is not yet objectified, has not yet become representation.[66]

Schopenhauer's evolutionism in combination with his Platonism meant that he had a world of becoming and a world of Being, the apparent interaction between the two explained away in the main thesis of The Fourfold Root. Plato remains a central component of the Will for his understanding of species in the organic world, as well as for his work on aesthetics. In the contemplation of the world of being, he found great solace and a way to escape from the traps of the phenomenal world. Albert Einstein who was a close reader of Schopenhauer[67] shared this sentiment as can be seen in the following delivery given at the celebration of Max Planck's 60th birthday:

> I believe with Schopenhauer that one of the strongest motives that leads men to art and science is escape from everyday life with its painful crudity and hopeless dreariness, from the fetters of one's own ever shifting desires. A finely tempered nature longs to escape from personal life into the world of objective perception and thought; this desire may be compared with the townsman's irresistible longing to escape from his noisy, cramped surroundings into the silence of high mountains, where the eye ranges freely through the still, pure air and fondly traces out the restful contours apparently built for eternity.[68]

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66 Schopenhauer, *World as Will and Representation,* Vol. 1, 174.

67 In Einstein's 1919 Berlin study, which was sparsely decorated, he had four photos on his wall. Three were British physicists; Newton, Faraday, Maxwell and the fourth was Arthur Schopenhauer. See Jurgen Neffe, *Einstein,* (Berlin: Rowohlt Verlag, 2005).

68 Albert Einstein, from an address at a celebration of Max Planck's 60th birthday in 1918, delivered

*"That are Thou" and the Upanishads*

Schopenhauer considered the often quoted Hindu saying, "The life of all these things, - *That art Thou*" as an expression of his great unifying idea.[69] Early Indian thought played a central role in Schopenhauer's understanding of the unity of the Will. Late in life Schopenhauer would say of his reading of the Upanishads that it was "the most profitable and sublime reading that is possible in the world; it has been the consolation of my life and will be of my death.[70]" One way to understand his interpretation of Kantian metaphysics is that he is adopting the Upanishadic insight and working it into the synthetic a priori of Kant's categories of the mind. Kant limited the insights available from his method to rational beings. Schopenhauer extends it to all things that Will and consequently suffer. Royce discusses the similarities between the Kantian insight and the Upanishadic one:

> …I am one with all that ever has been or that ever will be, either millions of ages ago or millions of ages to come…Space and time are, as the Hindoos declared, the veil of Maya or Illusion, wherewith the hidden unity of things is covered, so that, through such illusion, the world appears manifold, although it is but one.[71]

The unity of living things is the first major aspect of Schopenhauer's philosophy that has Eastern influence. The second is the concept of endless suffering. The possible nirvanic release from suffering is not possible for those caught in the cycle of suffering, that is, those that are living.

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before the Physical Society in Berlin. Albert Einstein, Ideas and Opinions, trans. Sonja Bargmann (New York: Three Rivers Press, 1954), 224-5.

69 Royce translates the phrase differently: "The inmost life of things is one, and *that life art thou*." Royce, *The Spirit of Modern Philosophy,*253-254.

70 Arthur Schopenhauer, *Parerga and Paralipomena,* 2 vols. Trans. E.F.J. Payne (Oxford: Clarendon Press, 1974; reprint in 2001), Vol. 2, 397. All translations from this text occur in Cartwright, *Schopenhauer: A Biography.*

71 Royce, *The Spirit of Modern Philosophy,* 252.

> We feel pain, but not painlessness; care, but not freedom from care; fear, but not safety and security. We feel the desire as we feel hunger and thirst; but as soon as it has been satisfied, it is like the mouthful of food that has been taken, and which ceases to exist for our feelings the moment it is swallowed.[72]

Although the essence of the Will is fixed and final, the nature of the essence is one of restlessness and hunger. This restlessness is embodied universally.

Schopenhauer's largest area of influence has arguably been within aesthetics, particularly his philosophy of music. In music Schopenhauer found the greatest expression of the Will, one that he studied with great zeal one of the aspects of his philosophy that we can say without hesitation seeped into the way he actually lived his life. Within his concept of the Will as expressed in music there is perhaps the clearest expression of the unity of the Will. He goes so far as to equate the two, stating: "We would just as well call the world embodied music as embodied will.[73]" A brief discussion of just how music is related to the Will is a way to tie together the Platonic, Upanishadic and Kantian influences and provide a transition to the next sections that more thoroughly discuss of the identity of the Will in the context of evolutionary theory.

Schopenhauer contended that at its finest Music is the expression of this Idea and that is why the experience of 'good' music stirs something deep within, it actually stirs our true identity and essence – the Will of which we are a mere objectification. "Therefore music is by no means like the other arts, namely a copy of the Ideas but a *copy of the will itself*, the objectivity of which are the Ideas.[74]" The will is pre-language, pre-representation, and it is in the felt experience of music that we are able to get a more

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72 Schopenhauer, *World as Will and Representation,* Vol. 2, 575.
73 ibid*,* Vol. 1, 263.
74 ibid, Vol 1, 257

intimate glimpse of the ultimate unified nature of reality. For those who were reacting to the sea change in physics, mathematics was an exercise that allowed one to touch the truth, for Schopenhauer it is Music that reveals the underpinnings of metaphysical reality.[75]

> Concepts are simply the tools of philosophy. They are abstracted from the world as representation and are incapable of expressing with the same precision and grandeur what could be expressed by music.[76]

The philosophical pleasures spoken of by Plato, Mill and many others are identical in nature to the appreciation of music for Schopenhauer. Consider the moment in Plato's Meno where the uneducated is led by his own innate knowledge through difficult mathematical work because, for Plato, the person already knows the truth of the Forms but has access blocked to it by embodiment. Compare this to Schopenhauer, who thinks that upon listening to a truly beautiful song, the pure voice of the Will, we are able to recognize its Form without any education, knowledge or training. Unlike Plato this is not because we were with the Forms before embodiment, but rather, for Schopenhauer we are the embodied Form of the Will and music stirs a recognition of our own essence in the behavior of music. Royce, as is often the case, states it best,

> Music shows us just the will is, - eternally moving, striving, changing, flying, struggling, wandering, returning to itself, and then beginning afresh, -- all with no deeper purpose than just life in all its endlessness, motion, onward-flying, conflict, fullness of power, even though that shall mean fullness of sorrow and anguish. Music never rests, never is content; repeats its conflicts and wanderings over and over; leads them up, indeed, to mighty climaxes, but is great and strong never by virtue of abstract ideas, but only by the might of the will that it embodies. Listen to these cries and strivings, to this infinite wealth of flowing

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75 ibid, Vol 1, 264
76 ibid, Vol 1, 318

> passion, to this infinite restlessness, and then reflect – *That art Thou*; just unreposing vigor, longing majesty, and – caprice.[77]

There is an identification here that Schopenhauer implores us to investigate. Is our connection to music a simply purposeless pleasure, or is it pleasurable because it is connecting to something greater than our own individuality? One consequence of this is that the question of free will takes a dramatically different, and vitalistic, turn. In an essay on free will he states it as follows:

> In a word, a human being always does only what he wills, and yet he necessarily does it. This is owing to the fact that he already *is* what he wills: for from what he is all that he ever does follows of necessity. If we consider his actions *objectively*, i.e., from without, we recognize apodictically that, like the actions of every being in nature, they must be subject to the law of causality in all its strictness. *Subjectively*, on the other hand, everyone feels that he always does only what he *wills*. But this means merely that his actions are the pure manifestation of his very own essence. Therefore if it could feel, every being in nature, even the lowest, would feel the same thing.[78]

The identity of this "same thing" that Schopenhauer contends music allows us to connect to is, as Royce describes it, an "infinite restlessness" that takes on new subjects. The cycle begins with a desire for some suffering to end and the striving is to attain that end. Yet as soon as the goal in mind is attained, a new one springs up.

> [T]he will dispenses entirely with an ultimate aim and object. It always strives, because striving is its sole nature, to which no attained goal can put an end. Such striving is therefore incapable of final satisfaction; it can be checked only by hindrance, but in itself it goes on for ever.[79]

This goes to the essential greed and want of nature. Even if the desire is for something easily achieved, there is never respite from the act of desiring.

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77 Royce, *The Spirit of Modern Philosophy*, 256.
78 Arthur Schopenhauer, *Essay on the Freedom of the Will,* trans. Konstantin Kolenda (Indianapolis: Bobbs-Merrill, 1960), 98.
79 Schopenhauer, *The World as Will and Representation*, Vol. 1, 308.

> Because we live, we must strive. However the actual content of our striving may be elaborated, its form, set by the will to life, locates us always somewhere on a cycle of willing and attaining. Any determinate episode of willing comes to an end, but not willing itself. Nothing we achieve by willing could ever erase the will itself.[80]

In summary, Schopenhauer acquires from Eastern philosophy both the concept of the unity of suffering life and the idea that suffering is a continually renewing cycle that is inescapable to most everything caught in its circle. The implications of this for human behavior, including Schopenhauer's own aesthetic solution, are outside of the scope of the present discussion. Nonetheless, the concept of the Will as an unknown, that is accessible through Kantian metaphysics, resembles a Platonic form in its immutability, and has the extension and disposition of Upanishadic concepts of suffering – provides a rich and comprehensive theoretical instrument for the investigation of living things as a whole. The rest of the chapter will turn to applying this theoretical instrument to the natural world.

## Section Three:

## The World-Will in Nature

The background now set, the rest of this chapter moves forward, first with a thorough analysis and interpretation of a full treatment of Schopenhauer's World-Will and then on to an application of this concept to some ongoing debates within philosophy of biology. Some specific examples will be helpful in providing a touchstone for the application of Schopenhauer's Will to contemporary evolutionary theory. A broad

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80 Christopher Janaway, "Schopenhauer's Pessimism," in *The Cambridge Companion to Schopenhauer* ed. Christopher Janaway (New York, New York: Cambridge University Press, 1999), 325.

understanding of his metaphysics is essential for the focused analysis of his philosophy of nature, and that is the task of this section. In the Second Volume of his magnum opus *World as Will and Representation,* he adds addendums to the previous work and provides further evidence for his earlier argument. Of greatest significance for the following discussion is the addition of "On the Will in Nature" as it places many of the consequences for his metaphysics within empirical biological examples. He notes that this particular essay is "really the essential supplement to this book.[81]"

Schopenhauer's World-Will can be described as a philosophy of nature in the sense that he was a hands-on empiricist and, like Aristotle's biology, took much of his inspiration from the observation of living things or from the first hand reports of others.

> For the process of the exact sciences he had a poor comprehension; for natural phenomena of a suggestive sort his eye was always very wide open; he longed to catch the restless World-Will in the very act of its struggle and sorrow…In nature itself, he was very fond of observing flowers, while, after his fashion, he loved animals passionately. They show the will naked, in all its naïve cruelty, guilt, and innocence.[82]

Plants, insects, animals and humans all are subjects for the investigation into what is going on in the world. Schopenhauer saw nature through his distinctly pessimistic lens and saw a world filled with suffering and death, whereas aesthetic beauty occurred as a distinct intellectual effort to remove oneself from the pull of this world. This is not the philosophy of nature as found in Paley's teleological Watch, or one that personifies nature into a happy Gaia, nor does it defend a beautiful and purposeful struggle.

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81 Schopenhauer, *World as Will and Representation*, Vol. 2, 191.
82 Royce, *The Spirit of Modern Philosophy,* 247-248.

*Cannibalism in Latrodectus hasselti*

There are no shortage of examples to choose from to do a thought experiment with Schopenhauer's World-Will. It may be useful, however, to confine the discussion to just two so as to help narrow the focus. The examples, a spider and a fish, will eventually receive a great deal of focus in the final two chapters, but in this introduction to the section they will only be presented and not analyzed in great detail. Schopenhauer has his own examples, such as moths that are provided with all the necessary tools to reproduce, but no mouths to maintain their existence after the Will's goal is accomplished. In an another example Schopenhauer discusses the lure of a mesmerized animal being hypnotized and lured by a predatory snake:

> [T]hat such a poor innocent squirrel…is compelled, step by step, reluctantly, struggling with itself and lamenting, to approach the snake's wide, open jaws and hurl itself consciously into these, is so revolting and atrocious, that we feel how right Aristotle is in saying…How frightful is this nature to which we belong! [83]

Schopenhauer's insight is continually reaffirmed; take for instance the Redback spider *Latrodectus hasselti*. A member of the same genus as Black Widows, the female is many times larger than the male. Remarkably, unless you are Schopenhauer, the Redback is a sexual cannibal. Upon completion of mating, the male sometimes vaults itself into the mouth of the female sacrificing its life. This occurs in about two-thirds of all mating events. Even if the male fails to do this, they usually die shortly after mating. Males who cannibalize themselves are able to fertilize more eggs, as sperm can be stored for up to two years and used over several batches of eggs. Males typically live only a

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83 Schopenhauer, *The World as Will and Representation*, Vol. 2, 356. Of note is the relatively small population of Europe at the time, and the wide and wild spaces to which Schopenhauer had access.

half a year whereas females live up to three.[84] As Maydianne and Andrade demonstrated, there are advantages to this behavior that make it evolutionarily adaptive. Females are less likely to have further mates if the first mate is consumed. Why this is the case only further adds intrigue to the overarching questions of why the male spider does this sacrificial act in the first place. The explanations from the paradigm of natural selection are multiple, but are all missing an important component that Schopenhauer can provide. What interests Schopenhauer about these sorts of examples, and he was familiar with many, is why does nature favor and make adaptive such a horrible practice?[85] In order for the individual to have offspring it must die. In order to propagate your own life, you must end it. Given these examples, it is difficult to contend that nature is moral, kind, or tending towards a higher state.

Both Plato and Aristotle contended that philosophy begins in wonder. Schopenhauer agreed, but it was a wonder that was tinged with worry. For other philosophers the wonder is initiated by things like beauty or order. For Schopenhauer, wonder springs from the universality of suffering and death.

> [I]f our life were without end and free from pain, it would not possibly occur to anyone to ask why the world exists, and why it does so in precisely this way, but everything would be taken purely as a matter of course.[86]

Not only is the suffering universal, but there does not appear to be any means of escape for Schopenhauer. The tendency of nature is such that it cares not for our well-

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84 C. Maydianne, B. Andrade, "Sexual Selection for Male Sacrifice in the Australian Redback Spider," *Science* 271 (1996): 70-72.

85 There is a worry here of anthropomorphizing Nature that I argue in later sections does not devastatingly weaken Schopenhauer's position. Nature is a hermeneutical device used to objectify general laws and principles in a way that makes them accessible and able to be discussed.

86 Schopenhauer, *World as Will and Representation,* Vol 2,161.

being and only sets up satisfaction as a false-hope to provide motivation for our actions. As he states it:

> [A]ll striving springs from want or deficiency, from dissatisfaction with one's own state or condition, and is therefore, suffering so long as it is not satisfied. No satisfaction, however, is lasting; on the contrary, it is always merely the starting point of a flesh striving, we see striving everywhere impounded in many ways, everywhere struggling and fighting, and hence always suffering. Thus [that] there is no ultimate aim of striving means that there is no measure or end of suffering.[87]

This is certainly true for the male Redback spider.

### *Sexual Competition in* Xiphophorus

A second example can be found in the swordtail system containing *Xiphophorus birchmanni* and *Xiphophorus malinche*, which are two sister species that are capable of producing offspring but prefer not to. This species uses olfactory and visual cues to differentiate conspecifics from heterospecifics when choosing mates. The most notable visual cue is the sword of the swordtail, which exists prominently in *malinche* populations but not in *birchmanni.* Interestingly, the ancestral *birchmanni* population possessed swords, and lost them. It has been suggested that the swords represent a false signal for body size and that this has been alternatively selected for and against. The sword can lead to attention from potential mates because of the 'sexiness' of the false size increase it suggests. Alternatively, false sword signal can be selected against because of its more immediate fitness cost, namely that it requires the investment of limited resources to produce the morphological trait. Also the larger sword reduces

87 ibid, Vol 1, 309.

swim speed and predator avoidance. *Malinche* females prefer the visual cues of the tail-less *birchmanni* but prefer the olfactory cues of conspecific *malinche*. As in most systems, the olfactory mechanism appears to play a strong role in preventing hybridization. There is a greater likelihood that offspring will not survive if they mate with members of another species.

Strangely, no wild-caught examples of first generation hybrids between the *birchmanni* and *malinche* species have been found, but there are many hybrids existing alongside and backcrossing with the parental species. Increasing the mystery is the fact that there are many backcrossed hybrids in the wild and in captivity[88], but it has been virtually impossible to produce viable hybrids between the parent populations in the lab so far. Most importantly, the *malinche* females now seem to 'know' something about *malinche* males. The sword causes slow swim speed and diverts resources away from the production of potentially more fitness enhancing traits.

Key to this line of questioning is Schopenhauer's emphasis on 'want', as in, why would the male want to do this? That is, what is the difference in how it becomes adaptive versus why it is so.[89] His answer is that there is a universal wanting that characterizes all things. It does not make sense to say that the individual fish wants, for it doesn't know what it should want for, yet it is defined and continues to exist in the next generation only because of the presence of a guided want. Cartwright describes it as follows: "By drawing from teleologically suggestive features of animal life and its

88 Swordtails are very popular fish amongst 'hobbyists' who often use hybridization as a means to create interesting phenotypes.

89 Further connections can be made to the sexual conflict literature.

adaptation to its environment, he concluded that this was due to a will, unguided by intellect.[90]" This want is its defining behavior and essence, how it is subjectively embodied in an individual is only relative to the obstacles it faces in attaining that goal.[91] It is not teleological in the sense that Paley uses when he talks about the watchmaker because it is a blind force. It might seem contradictory to say that a process is both blind and purpose driven, and explaining how this can be the case goes a long way to understanding Schopenhauer's vitalistic Will. Darwin explains this process as natural selection, which is valuable in explaining how a trait is shaped by deduction. Schopenhauer, on the other hand, adds the much needed explanation of the impetus of for life creating life in the first place. In essence, he goes one step further than Darwin and starts with the phenomena of life as the behavior that is in need of explanation. In other words, Darwinian natural selection helps us to understand the differentiation of living things, whereas Schopenhauer helps us to understand why things are there to differentiate.

Returning to the theme of the split between explanations of the world based on physics and those based on motivated behavior: Darwin provides the mechanism, the how of evolution, but Schopenhauer provides the heart and 'why' of evolutionary change. Descartes, Locke, and Kant assume that innate ideas do not require argument for them to be known. Schopenhauer asks the question, but where did they come from, and equates innate ideas with animal instinct, and reason with a behavioral trait. The cost is high for the sacredness of reason for humanity, but it does offer something like an

90 Cartwright, *Schopenhauer: A Biography,* 468.
91 There is a later connection here to Dewey's understanding of the concepts of growth and education.

explanation for how the spider knows how to spin a web, and why the female swordtail population can change preference over enough time without any individual consciousness of the folly of the false sword. The origin of one's innate knowledge is the suffering and death of our predecessors and the purpose is the indefinite continuation of that suffering.

### *The Hermeneutic of Schopenhauer's Anthropomorphism*

Without a question, Schopenhauer's metaphysics is anthropomorphic. I contend that even though this aspect of his philosophy has been one of the primary justifications for casting him aside as antiquated, it is this aspect of his philosophy that is most needed at the present moment. His position posits that we have access to the thing-in-itself through our immediate knowledge of our own Will, and analyzing our own desires allows us to access the trait of desire that is the same in all things. In essence, he says that our own personal experience once stripped of innate ways of perceiving the world such as time and space, gives us a key to understanding all of reality around us. We are trapped in a human body with human representations and phenomena. Further, we are stuck in space and time, and are constantly under the control of this deceiving will, and yet it is this insight into our own Willing being that allows us to generalize about all willing beings. In other words, by looking inwards and removing the components of our thinking that are unique only to the human condition we can gain access to the universal truths of all external objects outside of our mind. We could dismiss it because it does not work within the 18$^{th}$ century framework of the scientific method and its recent

incarnations in deterministic genetics, or we could accepts its flaws, which are due largely to Schopenhauer's hubris, and see what help he can provide.

The criticisms that are applied to other anthropomorphic worldviews also apply to Schopenhauer's position. There is justifiable fear of an overly self-confident and close-minded disposition if one begins with personal experience. It is also problematic in that there is not a clear measureable index to quantify this personal experience and compare it against others. These are entirely appropriate worries. Despite these worries, if we temper the aim of the thought experiment to a heuristic reading there is value. If the goal isn't to get at the truth of the metaphysical reality of the all living things, but to have a theoretical instrument to understand the behavior and motivations of human and non-human biological beings, then it can serve as a useful diagnostic, which addresses an aspect of behavior that is unable to be ever captured by a purely reductionist model. For example, a complete listing of all of the genetic underpinnings of a behavior, inclusive of their causal connections and developmental origins, will never get at what it is to be a bat, or to know why an individual would 'want' to do something. Want is posited as a byproduct in these systems rather than as the fundamental feature of reality, as it is in Schopenhauer, yet it seems to be the emergent phenomena of interest for most behavioral traits. Whereas the molecular biologist might ask us to ignore it as a symptom, Schopenhauer identifies it as the ultimate cause.

Returning to the question of his anthropomorphizing the Will. This is only true insofar as when we talk about The Will we are using it as a hermeneutic device to lift up and isolate a trend of living things. Is it a reality, yes, but this does not mean it is an

actual thing that takes up space of its own. It is an idea that is real in that it has consequences. It is no more real than photosynthesis in that it is a complex chain of events that has been shaped by countless repetitions and trimmed and shaped by suffering. There is no fight to be had by the dead. Nihilism and global extinction does not make the point, or teach the lesson to anyone, as The Will is only a trajectory and a momentum. Royce uses the stock market as example to discuss a similar line of idealism:

> A consensus of the thoughts of the buyer and sellers exists at any moment, which, however well founded, or again however arbitrary and changing this consensus may be, is expressed for the instant as if it were a hard and fast material thing in a genuinely outer world. In fact, prices and credits are ideas, and exist in the show-world of market values and of commercial securities, being but the projections of the various ideas of people as these at any moment agree to express themselves.[92]

In a similar mode, The Will is the culmination of the ideas of all living things, namely they are trying to live – this is inclusive of the mental consciousness of the ape, the instinctive responses of the beetle, and the random but describable and predictable Brownian motion of the smallest organisms. The idea continues to exist as long as the individuals who express it are thereby helped to produce offspring carrying that idea. Given that all living things come from a long history of selection for living tendencies it is not surprising that the software of the human consciousness is designed in a way so as to produce more humans, live longer, or create an imaginary revenge against the will via the postulation of eternal life in a place where the suffering does not reach. Is The Will evil as Royce contests? No, in a Nietzschian vein it has a unique and genius definition of

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92 Royce, *The Spirit of Modern Philosophy*, 234-235.

the good, namely existence and growth. Its concept of evil is non-existent in that it is nonexistence itself.

### *The Will to Life and Darwinian Natural Selection*

Schopenhauer defined the struggle for existence as a universal trait of the natural world 40 years before Darwin published *Origin of Species.* Schopenhauer does not go as far as to posit this struggle as a direct explanation for the creation of new species or for adaptation as cleanly and powerfully as Darwin. Lovejoy writes in 1910:

> The Darwinian hypothesis makes of species and their adaptive characteristics merely the result of a sort of mechanical pressure of external forces. Slight promiscuous variations, due probably to fortuitous displacements…are conserved or eliminated in the course of the jostle for survival, according as they do or do not fit the individuals possessing them to keep a footing in that turmoil But such a doctrine assigns to the organism itself, and to its inner potencies, an essentially passive role; development is, as it were, extorted from living things by external circumstances, and is not a tendency expressive of all that is most characteristic in the nature of organisms as such.[93]

In this passage there is a piece of the worldview of nature that is captured by Goethe, Dewey, Schopenhauer and Peirce. In contrast to Darwin, Schopenhauer's impetus for change comes from an internal source, as does Dewey's and Goethe's, and Peircian metaphysics attacks the very foundations of mechanistic determinism itself. The connection between these thinkers is not that they are exemplars of a "sort of generalized vitalism[94]" but that they are ecological, a word which was not ascribed by their

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93 Lovejoy, "Schopenhauer as an Evolutionist," 220-221.

94 M. Rene Berthelot, *Evolutionnisme et Platonisme* (Ann Arbor: University of Michigan Library, 1908), ii. Berthelot referring to Schopenhauer.

contemporaries but a movement that has philosophical and theoretical roots in their theories.

Schopenhauer's understanding of the Will, or what he often calls in the context of biological entities the Will to Life, is not an interchangeable equal to Darwin's Natural Selection. I say this knowing quite well that Darwin's own position was amorphous, and itself undergoes several stages of modification in light of his own historical situation. Schopenhauer's first application of his metaphysics to evolutionary theory came prior to Darwin's publication of Origin and the connection between the two was made almost immediately. As early as 1866 an article appeared in the *Journal of Anthropology* entitled "Schopenhauer and Darwinism.[95]" There was an evolutionary movement in the air in both the German or English traditions and despite this initial association of the two theories, there is little current mention of them.

In the twentieth chapter of Darwin's later work *The Descent of Man, and Selection in Relation to Sex* published in 1871[96], he cites from Volume 2 of Schopenhauer's *World and Will as Representation* regarding sexual competition within humans. Schopenhauer's passage cited by Darwin is as follows:

> The final aim of all love's intrigues, be they comic or tragic, is really of more importance than all other ends in human life. What it all turns upon is nothing less than the composition of the next generation…It is not the weal or woe of any one individual, but that of the human race to come, which is here at stake.[97]

Present in this passage are the usual Schopenhauerian themes that rely on the absolute claim that it "all turns upon the composition of the next generation" and the Upanishadic

95 David Asher's "Schopenhauer and Darwinism," *Journal of Anthropology*, 1(1866).
96 Charles Darwin, *The Descent of Man, and Selection in Relation to Sex* (London: John Murray, 1871).
97 ibid, 599.

concept that there is something more than the individuals concerns that are at stake, " that of the human race to come", or one might say of the species as a whole. Another way to interpret it is that the ultimate aim and meaning of love is hidden from the individual.

Both philosophy and biology of the 19th century tended to take a view of nature as a pleasant place and perhaps the greatest relation between Darwin and Schopenhauer is their rejection of that depiction of nature. Gale notes that:

> Although struggle and conflict in nature were thus recognized in the pre-Darwinian period, at the same time there were so many elements working against struggle or channeling it into useful purposes that the natural world could be viewed as – if not a rather pleasant sort of place – at least a well-balanced, harmonious system in which organisms might exist.[98]

This depiction of nature is in complete opposition to a foundational assumption of Schopenhauer's philosophy of nature, and is a notion that is to this day still the mainstream position. The view of nature as a place with a growing amount of happiness and order is a foundational doctrine of the Natural Theology espoused by William Paley and others that explained adaptation not as a fight against a wild environment but as the perfecting of a divine creation. Consider the assumed artificiality of catastrophic struggle as depicted by another figure on the brink of the evolutionary turn, the French naturalist Buffon:

> What else do animals which we classify as wild animals – because they are not dependent on us – require to achieve happiness? Peace reigns amongst them and war is only inflicted by strangers or by us.[99]

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98 Barry Gale, "Darwin and the Concept of a Struggle for Existence: A Study in the Extrascientific Origins of Scientific Ideas," *Isis* 63:3 (1972):321-344, at 327.

99 George-Louis Leclerc, Comte de Buffon, "La histoire naturelle des oiseaux," in *Oevres completes* (Paris: De l'Imprimerie Royale, 1884), Vol. 5, 209. Quoted in Gerhard Wichler, *Charles Darwin, The Founder of the Theory of Evolution and Natural Selection* (New York: Pergamon Press,

In response to this view of nature, Schopenhauer might consider him blind, Dewey might contend that all of nature is a "stranger", and Peirce might classify us all as "wild", animals and humans alike. Heraclitus as well does not share this view of nature: "We must realize that war is universal, and strife is justice, and that all things come into being and pass away through strife." Similar notions are found in Darwin: "[E]ach organic being …has to struggle for life, and to suffer great destruction[100]" and "each lives by a struggle…[and]…heavy destruction inevitably falls either on the young or old..[101]" Again, the contrast between the positions could not be more stark.

The costs of not separating these two ideologies in the design of contemporary research agendas is subtle but far reaching. At the heart might be a failure to undertake an objective investigation. For instance, Robert Chambers in *Vestiges of the Natural History of Creation* in 1847 said that given the idea of God and his observations of the nature that: "We are forced to acknowledge that everything is very good.[102]" It was this very book that Schopenhauer drew much of his initial ideas and criticisms of evolutionism. Erasmus Darwin also saw the savagery of nature referring to it as the "great Slaughter-house" but similarly explained away its savagery with notions of hierarchical progress inherent and perhaps designed. Referring to old age and death Charles Darwin's grandfather wrote:

> …it is so ordered, that as soon as any organized being becomes less irritable and less sensible, and in consequence feeble or sickly, that it is destroyed and eaten by other….more vigorous organized beings; as insects attack the weaker

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1961), 93.

100 Charles Darwin, *On the origin of species by means of natural selection, or the preservation of favoured races in the struggle for life*, (London: John Murray, 1859), 78-79.

101 ibid, 66.

102 Robert Chambers, *Vestiges of the Natural History of Creation* (London: John Churchill, 1847), 266.

> vegetable productions in preference to the healthy ones; and beasts of prey more easily catch and conquer the aged and infirm, and the young ones are defended by their parents. By this contrivance more pleasurable sensation exists in the world, as the organized matter is taken from a state of less irritability and less sensibility, and converted into a state of greater; that is in other words, that the old organizations, whether stationary or locomotive ones, are transmigrated into young ones…[103]

Erasmus Darwin's view acknowledges suffering and struggle, but insists that the whole process increases the amount of happiness in the world and operates on a hierarchical model in which the world continues to improve. Schopenhauer had no such teleology:

> [T]he will dispenses entirely with an ultimate aim and object. It always strives, because striving is its sole nature, to which no attained goal can put an end. Such striving is therefore incapable of final satisfaction; it can be checked only by hindrance, but in itself it goes on for ever.[104]

Charles Darwin can be allied with Schopenhauer in rejecting the hierarchical place of the rational implied here. It is not difficult to see where the reviewer got this understanding given texts such as the following from the *Origin*:

> We behold the face of nature bright with gladness, we often see superabundance of good; we do not see, or we forget, that the birds which are idly singing round us mostly live on insects or seeds, and are thus constantly destroying life; or we forget how largely these songsters, or their eggs, or their nestlings, are destroyed by birds and beasts of prey: [and]…we do not always bear in mind that though food may be now superabundant, it is not so at all seasons of each recurring year.[105]

One of the benefits of seeing nature in this way is that the cycle of suffering is not one motivated by attaining a predetermined outcome, but is itself the phenomena of interest. In the following passage, Schopenhauer redirects our gaze to the act of striving

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103 Erasmus Darwin, *Phytologia; or, The Philosophy of Agriculture and Gardening* (London: J. Johnson, 1800), 557.
104 Schopenhauer, *World as Will and Representation,* Vol. 1, 308
105 Darwin, *On the Origin of Species,* 62.

itself and in so doing presents an ecological view of nature that is not by individual stages along a progressive line, but to the whole of the cycling struggle itself.

> Because we live, we must strive. However the actual content of our striving may be elaborated, its form, set by the will to life, locates us always somewhere on a cycle of willing and attaining. Any determinate episode of willing comes to an end, but not willing itself. Nothing we achieve by willing could ever erase the will itself.[106]

Instead of actually viewing the phenomena of the present struggle as Schopenhauer would have us do, the alternative view understands all of nature's activities through a lens tinted by an unknown, but hoped for, future. Schopenhauer's alternative view looks at the actual moment of living things and nowhere sees this promise fulfilled:

> We feel pain, but not painlessness; care, but not freedom from care; fear, but not safety and security. We feel the desire as we feel hunger and thirst; but as soon as it has been satisfied, it is like the mouthful of food that has been taken, and which ceases to exist for our feelings the moment it is swallowed.[107]

The eye with which Schopenhauer views nature is consequently both a holistic one and an empirical one. He forms his opinion of the whole not on any random version of telos, but instead on his experience of being alive and his actual investigations of the natural world. It is honest and genuine in this regard. From this phenomenologically present view of nature he derives his universal Idea, and the result isn't an end state or a purpose, but a feeling of restlessness that continues only because it ceases to be if it ceases to be restlessly willing. This, in short, is his evolutionary theory. Things exist because they suffer, if they did not suffer they would cease to be. Evolutionary change occurs as new ways to suffer are chanced upon. The comparison to the Darwinian

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106 Christopher Janaway, "Schopenhauer's Pessimism," in *The Cambridge Companion to Schopenhauer,* ed. Christopher Janaway (New York: Cambridge University Press, 1999), 318-343, at 325.

107 Schopenhauer, *World as Will and Representation,* Vol. 2, 575.

notion of struggle is helpful in outlining some important distinctions between the two. Consider Darwin's statement:

> A plant which annually produces a thousand seeds, of which on an average only one comes to maturity, may be more truly said to struggle with plants of the same and other kinds which already clothe the ground. The mistletoe is dependent on the apple and a few other trees, but can only in a far-fetched sense be said to struggle with these trees.[108]

Present here is the competition of Schopenhauer's World-will as well as the balance between organism and environment present in Dewey. The struggle itself is the essence of this balance. It need not be within itself, with others of the same population, or across species, the struggle can also be with the environment: "When we reach the Artic regions, or snow-capped summits, or absolute deserts, the struggle for life is almost entirely with the elements.[109]" *Latrodectus hasselti* and Schopenhauer's own examples of mouthless moths depict a nature in which competition against other individuals fuels growth and future instinct. Each individual is a unit of the willing acting on behalf of the will, but doing so by fighting against and feeding off of other individual units of the will. Schopenhauer provides a mechanism for how competition and the feeding off of other objectifications of the Will aids the will in its intent. He notes: "Every grade of the will's objectification fights for the matter, space, and the time of another.[110]" An example of this can be found in the ecology of parasite host relationships.

Parasites are an interesting example of a way of being competitively alive that something that has historically been considered an unnecessary remainder in the

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108 Darwin, *On the Origin of Species,* 62-63.
109 ibid, 68.
110 Schopenhauer, *World as Will and Representation,* Vol.1, 147.

classical hierarchical view of the food chain. They are something to be gotten rid of, a sign of impending evolutionary failure, and in general something to avoid. On the Schopenhauerian model, parasites are instigators of competition, they push the Will by challenging the Will and the result is new incarnations of itself that would not have been there if the parasite/host relationship did not exist. They represent competition against the environment, against other species, against other individuals, against time, random change and randomness in general and are certainly representations of the World-Will in this regard. The presence and competition with parasites has created a lasting echo, a continual developing plot line revolving around our competition with various parasites.

The parasite's impact on our evolutionary trajectory is that it moves us along, static change allows the more rapidly evolving (because of their population numbers, short lifespans, and large offspring size, in other words they are more fecund) parasites to catch up. So we can't stay still, variation is necessary in the case that the parasites hone in on a particularly lethal strategy. One can easily see Schopenhauer's World-Will in the description of parasite host conflict. It self-propagates on its own death, it needs itself to create diversity so that it can stave off the diminishing of the will.

Schopenhauer was well versed in the evolutionary theory that preceded Darwin and took a particular interest in Lamarck but ultimately disagreed with his position. Schopenhauer's unified Will thrashes and bursts into open spaces which become permanent shapes only if they work and continue life, Lamarck's version casts the memory of nature as having more of a focused intent, a plan carried out by each individual life. Schopenhauer contends that Lamarck:

> assumes the animal to be at first without definite organs and without definite tendencies also, possessing solely the power of perception. Through this means it learns to recognize the surroundings in which it has to live, and from this recognition arise its efforts, i.e. its will; from this come finally its organs, or definite bodily form; this is indeed helped by reproduction and by unlimited time.[111]

Lamarck, and the vast majority of evolutionary thinkers, begin with a "hypothetical primary animal" that anchors the origin of life a long time in the past.[112] The metaphysical assumption of the evolutionist that contrasts the most with the Schopenhauerian worldview is the contention that there has been gradual increasing of intensity from this primordial start. Embedded in this worldview is a hierarchical belief that nature is going somewhere, that it has a teleological purpose that it is in the process of fulfilling. Regarding the presumption of likeminded intelligence in the creating forces of nature Russell writes:

> It is a manifestation of the Will, and owes nothing to intelligent planning. Intelligence is entirely subordinate to the Will; it has been invented by Nature to enable the animal to survive; it is a means to life and subordinate to and derivative from life itself.[113]

The examples of apparent purposiveness are still held up as evidence of an intelligent designer, the spider's web, the honey bee's comb, the termite's nest, and so on. These are obvious ones available to Schopenhauer, and notably contemporary biology continues to discover the wigglings of the will mistaken as purposive in newly discovered structures such as complete genomes, the many faceted relationships among

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111 Schopenhauer, "Vergleichende Anatomie," 15.

112 E.S. Russell, "Schopenhauer's Contribution to Biological Theory," in *Science Medicine and History: Essays on the Evolution f Scientific Thought and Medical Practice,* ed. E. Ashworth Underwood (New York: Oxford University Press, 1953), Vol. 2, 203-210, at 207.

113 Russell, "Schopenhauer's Contribution to Biological Theory," 208.

the developing organism, and the impact that epigenetic modifications can produce in offspring several generations down the road. Schopenhauer contends that in all cases the purpose of all transmissions of form across time are not the fulfilling of a higher goal, but toward the single unaesthetic aim of More.

Schopenhauer's Thing-in-itself, the Platonic Idea of More, exists outside and primary to the physical world. Anything that is in the physical world swims in its sea. It is the water that buoys living things above inanimate objects. It has an emotional pull, it has constraints, it has influence, it assigns meaning and it cannot be overcome or redirected by the intentional effort of any one individual.

Let us return briefly to the biological examples that we started with. Does the spider or the fish have knowledge? When we ask "Why would the individual do that" we not only ask about it on a group selection level, but on a biologically overarching level, the ultimate group, the group that selects for Living, the unifying behavior, the replication and increase of the Will. The fish don't know that swords are a false signal, but they do know in a way, their instincts know and guide their behaviors.

> But in yet another respect instincts and the animal organization mutually illustrate each other, namely through the anticipation of the future which appears in both. By means of instincts and mechanical tendencies, animals provide for the satisfaction of needs they do not yet feel, indeed not only their own needs, but even those of their future offspring. Hence they work for a purpose still unknown to them.[114]

In other words, innate ideas are our preparation for the unknown future. They allow a framework for adaptation. Still, and this is the crucial difference between a hierarchical teleology and Schopenhauer's, there is no guarantee that extinction will not occur. In

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114 Schopenhauer, *World as Will and Representation,* Vol.2, 347.

fact, a species might be driven to it by the same innate idea that was previously advantageous. The false signal of the swordtail is a telling example. If those preferences lead one to believe that something is beautiful or pleasant when in fact it is potentially lethal for future generations, there is no mechanism for the individual to change their innate ideas and avoid the false signal. The change must occur on a grander level, if at all. A common example of this is the correlation between the pleasure derived by humans from sugars and fats, a innate desire that had its advantages in times when food was not as plentiful but which has led to epidemics of obesity and diabetes in our own time. People know that they should not want, but want is a force much greater than the individual in most cases. Consider as well the passage from Dostoevsky's *Notes from the Underground:* "I admit that twice two makes four is an excellent thing, but if we are to give everything its due, twice two makes five is sometimes a very charming thing too.".[115] And in the case of the reproduction of the Will, it is the prettier that often gives the individual the benefit in sexual competition. It is irrational to have a long sword that slows your swim speed, just as it is irrational to think that 2+2=5, but reason and logic are not the rulers of the World-Will.

### *The Will to Life and Sexual Selection*

"There is no passion as serious as lust.[116]" Sexual selection is usually distinguished from natural selection in that natural selection is ruled by survival whereas

115 Fyodor Dostoevsky, *Notes from the Underground,* trans. Richard Pevear and Larissa Volokhonsky (New York: Alfred A. Knopf, 1993), part 1 chapter IX. Originally published in 1864.
116 Schopenhauer, *Manuscript Remains*, Vol. 1, 45.

sexual selection determines reproduction. Darwin's 1871 *The Descent of Man and Selection in Relation to Sex* set the standard for this distinction.

> The sexual struggle is of two kinds; in the one it is between individuals of the same sex, generally the males, in order to drive away or kill their rivals, the females remaining passive; whilst in the other, the struggle is likewise between the individuals of the same sex, in order to excite or charm those of the opposite sex, generally the females, which no longer remain passive, but select the more agreeable partners.[117]

Sexual selection is often portrayed from the side of the trait that is selected; the peacock feathers, the dance of the Birds of Paradise, and the sword of the swordtail. Yet we note, essential for these traits to have the success that they are intended to have is a preference on the part of those individuals that are attracted by those traits. Quantifying the trait of preference is much more difficult than quantifying the morphological feature that inspires the preference. This is because it is cognitive, it is a desire. Seen through the lens of Schopenhauer's Will natural and sexual selection are expressions of the same drive. There may be morphological underpinnings, and we can maybe measure when a desire is initiated by measuring bodily change after contact with the preferred trait, but the strength of the interest itself lies always in the unknown of the cognitive activity of the organism. Here is one of the places where Schopenhauer can be of greatest service. He does not offer a yardstick or any measuring device that allows us to a question about 'how much' or 'what kind,' instead he offers a paradigmatically different type of explanation. The Will tells us 'what for,' and 'to what end.' They are questions that are explanatorily useful and rich with meaning but they are of any entirely different kind of tool than what is usually sought for.

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117 Darwin, *The Descent of Man and Selection in Relation to Sex*, 637.

One interesting consequence of accepting Schopenhauer's will to life is that the emphasis on reproduction and on the formation of the next generation suggests that sexual selection may be secondary to natural selection. It is often posited that sexual selection is just a type of natural selection and one that is not needed for the explanation of a great deal of evolutionary change. Will embodies the subjectified organism and uses it as the representation of its desire for the purpose of reproduction. Many behaviors, even those of the asexual and the single celled can be seen as driven by the same mental insight that explains sexual preference. Schopenhauer notes that "[T]he focal point of this affirmation [of this temporal consciousness] is the satisfaction of the sex drive.[118]" Satisfaction of the drive of the Will itself is found only in the creation of More, sex is merely one expression of this, as is the survival instinct of natural selection.[119]

Another area where Schopenhauer's concept allows us to unify the driving force behind sexual and natural selection is in organisms where reproduction is done asexually such as in viruses, bacteria and some parasites. In those situations the Will to Life is exhibited more directly and with fewer noticeable aesthetic flares. The Will expressed

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118 Schopenhauer, *World as Will and Representation*, Vol.1, 74.

119 The scope of this work is limited to the biological expression of Schopenhauer's Will so the extension of this concept to socio-economic expression is relegated to a footnote. One way to understand Marx's criticism of Capitalism is to understand the motivating force behind capitalism as Schopenhauer's Will. Marx contends that one the primary functions of capitalism is the creation of more capitalists. Capitalism requires that there is a desire for More and that there are more that want More. The owners of the means of production have no choice but to make a greater and greater profit, the systematic growth of the system occurs because of the nature of the system itself. The necessity which Marx places on capitalism's eventual polarization places the momentum of the the Idea of capitalism hierarchically above the free choice of any individual capitalist. In both Schopenhauer's view of nature and Marx's depiction of capitalism, there is no person behind the curtain, for, it is the momentum of the idea itself that lends to its continued existence, and it must create different versions of itself to continue growing from the consumption of its own creation. I recall John Steinbeck, in the *Grapes of Wrath,* to wit: "When the monster stops growing it dies, it cannot stay one size."

in sexual impulse, is identical to the one expressed by bacteria. The difference is merely one of expression and one that we have romanticized, held up as beyond reproach, and fairy tailed, but which has just under its thin skin the motives and purpose of the Will to Life. Fate has the same author for the bacteria as it does for the story book hero. Consequently, our belief in control over our own behavior is an illusion. Speaking to this in the section of *The World as Will and Representation* entitled: "The Metaphysics of Sexual Love" Schopenhauer, foreshadowing Freud, notes:

> Next to love of life, it [sexual impulse] shows itself as the strangest and most active of all motives, and incessantly lays claim to half the powers and thoughts of the younger portion of humankind. It is the ultimate goal of almost all human effort…It does not hesitate to intrude with its trash, and to interfere with the negotiations of statesmen and the investigations of the learned. It knows how to slip its love-notes and ringlets even into ministerial portfolios and philosophical manuscripts. Every day it brews and hatches the worst and most perplexing quarrels and disputes, destroys the most valuable relationships, and breaks the strongest bonds. It demands the sacrifice sometimes of life or health, sometimes of wealth, position, and happiness. Indeed, it robs of all conscience those who were previously honorable and upright, and makes traitors of those who have previously been loyal and faithful.[120]

It may seem coarse to suggest that all desires and motivations share the same impetus as that of lust, but because sex is one of the primary means of shuffling the genetic deck and in overcoming the finite limitations of time it is a necessary function that the Will undertakes to get its job done, to fulfill the calling of its essence. The fact that it smacks of derision toward the lofty human realm of activity is, like our elevation of reason, a decoy of the Will in order to keep us working towards the Will's goals without considering what rebellion would look like.

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120 Schopenhauer, *World as Will and Representation*, Vol. 2, 544

Schopenhauer is often accused of poisoning the well here. If one wants to say that there are things that nature does that are not done in the service of reproduction Schopenhauer has a ready-made response for all of them. One objection might be, what about organisms that themselves don't reproduce, as in hive communities such as bees and ants? Schopenhauer could reply that the individual is not the Will's concern and as long as the activity of the non-reproducing individual aids in the goal of creating More for the hive or the species then it is still in service to the Will. The Will does not care about the individual; it makes perfect sense that the vast majority of individuals should sacrifice their lives in order to allow the Idea of the Species to continue existing.

### *Adaptation and Parsimonious Development*

As discussed above, there is no special place for human reason in Schopenhauer's philosophy of nature. Reason is merely the expression of the Will that has allowed us to continue the purpose of the will in our special niche of the world. The sloth has no use for reason, nor does it have use for speed; the pragmatic function required to survive and reproduce provides the ultimate guideline for trait selection. This aspect of Schopenhauer's philosophy of nature provides a transition to the following chapter on John Dewey as an anti-reductionist. Schopenhauer's and Dewey's positions are undoubtedly distinct, but on the question of parsimony and adaptation there are shared dispositions.

The mindlessness of the Will's expression is such that there is no aesthetic effort; there is no superfluous additions of nature's brushstrokes that do not serve its purpose.

Schopenhauer notes: "[W]aders have neither talons, like the birds of prey, nor webs, like the ducks, for Nature's law of parsimony permits no superfluous organ.[121]" Consider the following passage regarding the 'fit' of an animal with its environment:

> Young-he goats, rams and calves butt with their bare polls before they have any horns; the young boar strikes all round him, while the tusks which would make this effective are still wanting; yet he does not use the smaller teeth which are already in his mouth and with which he could really bite.[122]

There is an adaption present that is caused by pressures from the external environment as well as from an internal innate expression. There is more going on here in Schopenhauer than in many contemporary expressions of the origin of adaptation. Russell states the necessity of adaptation the following way:

> We may say that an organism is adapted to its environment when, through its specialized structure and activities, it can satisfy in that environment all its essential needs and requirements for the completion of its life-cycle; if it is not so adapted, it obviously cannot exist as an individual or persist as a species. Adaptation to environment is therefore a primary condition of its existence.[123]

For Schopenhauer, there is first and foremost the positive vitalistic force of the Will.[124] This force comes up against the competition found in its environment and is pressed by the limiting constraints of time and space that are a byproduct of its objectification. The combination of the initiating impetus and the adaption to the environment accounts for differences among organisms as well as providing a historical account of their origin. He notes, "partly on the unity and identity of the will to live, partly on the fact that the

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121 Schopenhauer, "Vergleichende Anatomie," 36**.**
122 ibid, 42.
123 Russell, "Schopenhauer's Contribution to Biological Theory," 205.
124 The impetus aspect of Schopenhauer's Will shares many similarities with Bergson's vitalism. Bergson suggested a different mechanism than Darwin. Bergson suggested that a natural impulse, *élan vital*, was the driving creative force of evolutionary change. See Henri Bergson, *Creative Evolution,* trans. Arthur Mitchell (New York: Henry Holt and Company, 1911)

archetypal forms of animals have all followed one from the other, with the result that the fundamental type of the whole stock has been continued.[125]"

Darwin echoes this insight thirty years after Schopenhauer published *On the Will in Nature.* While discussing why it is that plants do not have nerves that respond to external irritation he notes: "indeed it is not probable that they should be so, as nature always economizes her means, and irritability would have been superfluous.[126]" And a few lines later, "The two or three, or even more, internodes which are first formed above the cotyledons, or above the root-stock of a perennial plant, do not move; they can support themselves, and nothing superfluous is granted.[127]" The sentiment expressed is that there is a need for adaptation to the pressures of an environment, but that there is no need to have more of something than is necessary to get the job done. The same concept explains the suicidal behavior of *Lactodectus hasselti*, as well as the selection against swords that are not helping the population increase in number. Nothing superfluous is allowed, even life as long as that life is not actively creating more life. This also applies to intelligence and the mental aspect of the Will:

> Nature does not give a species more intelligence than it needs; she obeys the law of parsimony. The instinctive behavior of insects is specialized and adapted to their normal conditions of life; in an abnormal or unusual circumstance they may behave unpurposively, as when the moth flies into the candle flame. Nature made no provision for this unlikely contingency, and in normal circumstances insect intelligence is just sufficient or adequate for its need.[128]"

125 Schopenhauer, "Vergleichende Anatomie," 54.
126 Charles Darwin, *The Movements and Habits of Climbing Plants* (London: John Murray, 1865), 16.
127 ibid, 33.
128 Schopenhauer, "Vergleichende Anatomie," 45.

The greater the individual's complexities of behavior the more intelligence is given, if choices are not required for continued proliferation of the Will then intelligence is not present.

> ..[T]he animal's body is the Will itself, as represented in the brain under the forms of Space, Time and Causality – in short, the Will made manifest as a visible object. For granting this assumption, everything in or connected with the body must conspire towards one object, the life of the animal. We can find in it nothing useless, nothing superfluous, nothing wanting, nothing uncorrelated, nothing insignificant or in its kind incomplete. Everything that is requisite must be there, to the exact degree demanded, but no further.[129]

The economy of the Will's expression in combination with the skillful art and cunning of the Will's strategies of creating more of itself leads to an emphasis on internal harmony within a developing organism. In this regard, Schopenhauer is intimately connected with both Goethe and Dewey. Potentially taking a cue from Cuvier, Schopenhauer emphasized the "the internal harmony and functional unity of organization[130]"that responded both to the constraints of the external environment and the constraints of finding the quickest and most efficient internal developmental path of allowing the organism to deal with those externals.

> It follows from my system, that each creature is its own creation. Nature, who never lies and is as unsophisticated as genius, frankly expresses the same thing, for each being only lights, as it were, its own torch at that of another, its exact replica, and then before our very eyes makes itself, taking its material from outside, but its form and movement from within itself; this we call growth and development. Thus, empirically, every creature stands before us as its own creation. But men do not understand the language of Nature, because it is too simple.[131]

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129 ibid, 35.
130 E.S. Russell, "Schopenhauer's Contribution to Biological Theory," 205.
131 Arthur Schopenhauer, *On the Will in Nature*, trans. E.F.J. Payne (New York: Berg, 1992), 58.

This "language of Nature" as Schopenhauer calls it is simple, not because it is easy to comprehend, but because of the unity of its purpose and the singularity of its identity. Keeping this simple idea of nature in mind the next chapter focuses on the actual mechanisms of this process using John Dewey's concept of Growth, an idea that has great accord with Schopenhauer's parsimony of nature. Consider side by side the following passages, the first from Schopenhauer, and the second from Dewey:

> The basis of all willing…is need, lack, and hence pain, and by its very nature and origin [any animal] is therefore destined to pain. If, on the other hand, it lacks objects of willing, because it is at once deprived of them again by too easy a satisfaction, a fearful emptiness and boredom come over it; in other words, its being and its existence itself become an intolerable burden for it. Hence its life swings like a pendulum to and fro between pain and boredom, and these two are in fact its ultimate constituents.[132]

> Life itself consists of phases in which the organism falls out of step with the march of surrounding things and then recovers unison with life, the recovery is never mere return to a prior state, for it is enriched by the state of disparity and resistance through which it has successfully passed. If the gap between organism and the environment is too wide, the creature dies. If its activity is not enhanced by the temporary alienation, it merely subsists. Life grows when a temporary falling out is a transition to a more extensive balance of the energies of the organism with those of the conditions under which it lives.[133]

For Arthur Schopenhauer life is suffering. For John Dewey life is an undergoing, that is suffering to grow. We bud, flower, die and rot and although Schopenhauer provides much insight into this cycle, in particular the rotting part, there is an absence of comment on the potential to flower.

> Any account of experience must now fit into the consideration that experiencing means living; and that living goes on in and because of an environing medium,

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132 Schopenhauer, *The World as Will and Representation,* Vol. 1, 312.

133 John Dewey, *The Philosophy of John Dewey,* ed. John J. McDermott (Chicago: University of Chicago Press, 1973), 535.

> not in a vacuum. Where there is experience, there is a living being. Where there is life, there is a double connection maintained with the environment.[134]

Similar to Schopenhauer, Dewey's conception of the state of humanity involves an agent, an agent which is in a body, which has built in desires and needs which require it to interact with its environment. This interaction is often a precarious one, and if not properly nurtured can lead to stagnancy or the end of the organism, and eventually the species. The main difference between these two thinkers is that for Dewey life can grow and be nurtured if the organism can come into harmony with the demands of the environment. Dewey's position is not the previously criticized hierarchical view of nature that presupposes that life is going somewhere and that the amount of pleasure in the world is increasing, but there are "consummatory experiences" in Dewey that in Schopenhauer are always colored by the eventual vacuum that follows them. Whereas for Dewey, the vacuum can be the initiation of a new experience laden with possibility for growth. Experience in Dewey pulls us out of our obsession with what has come or will come and draws our will begrudgingly closer to the moment by combining one's past with wariness towards the future. Another similarity with Schopenhauer emerges here. If one focuses too strongly on the ends of the process, the process rarely has significance for the willing agent, and is frustrated. In Schopenhauer we saw how the ends can never be attained because their attainment caused desire to just switch objects. In Schopenhauer, one solution was to cease desire for the ends, whereas in Dewey when we turn away from pure focus on attaining ends there is a simultaneous bolstering of the importance of the process of undergoing. "A "conclusion is no separate and independent

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134 Dewey, *The Philosophy of John Dewey,* 61.

thing; it is the consummation of a movement.[135]" Things will be accomplished and objects may be obtained, but only as a stroke of a continuing movement and not as the final resting point.

> Triumphs are dangerous when dwelt upon or lived off from; successes use themselves up. Any achieved equilibrium of adjustment with the environment is precarious because we cannot evenly keep pace with changes in the environment.[136]

Dewey echoes Schopenhauer's warning that success is fleeting. As soon as we reach the object of our stability, the environment changes and the precarious re-emerges. Success is fleeting and the precarious always hides in its shadow constantly deteriorating the stability to the point of eventual collapse. The collapse necessitates more suffering and struggle but it does not always entail misery with it. Schopenhauer equates the two, suffering and misery, and thus concludes that life is necessarily miserable, whereas Dewey sees some room for growth.

> While backed in part by the environment, its life is anything but a peaceful exhalation of environment. It is obliged to struggle-that is to say, to employ the direct support given by the environment in order indirectly to effect changes that would not otherwise occur. In this sense, life goes on by means of controlling the environment. Its activities must change the changes going on around it; they must neutralize hostile occurrences; they must transform neutral events into co-operative factors or into an efflorescence of new features.[137]

Dewey is not naively optimistic. It will come to no better end, the king and pauper both end in the ground, but the experience which is had before death can often be in tune with the environment and this can allow growth internally and across generations. Notice in

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135 Dewey, *The Philosophy of John Dewey,* 557.
136 Dewey, *The Philosophy of John Dewey,* 63.
137 ibid, 62. The use of the word "controlling" here by Dewey, is troubling.

the following passage from Dewey's *Experience and Nature* that amidst the precarious and the failure there is the potential for the emergence of a strength of a sort.

> Man finds himself living in an aleatory world; his existence involves to put it baldly, a gamble. The world is a scene of risk; it is uncertain, unstable, uncannily unstable. Its dangers are irregular, inconstant, not to be counted upon as to their times and seasons. Although persistent, they are sporadic, episodic. It is darkest just before dawn; pride goes before a fall; the moment of greatest prosperity is the moment most charged with ill-omen, most opportune for the evil eye. Plague, famine, failure of crops, disease, death, defeat in battle, are always just around the corner, and so are abundance, strength, victory, festival and song. Luck is proverbially both good and bad in its distributions. The sacred and the accursed are potentialities of the same situation; and there is no category of things which has not embodied the sacred and accursed; persons, words, places, times, directions in space, stones, winds, animals, stars.[138]

Two particular themes are emerging out of Dewey that are vital to the next chapter's discussion. The first is that we all organisms come into life with ready-made tendencies, whether they be genetic or otherwise. In other words, instinct and the body cannot be ignored. The second is that nature is Wild, transitory, and satisfaction is fleeting.

138 ibid, 278.

# CHAPTER IV

## GROWTH AND PROCESS IN EXPLANATIONS OF EVOLUTIONARY CHANGE:

## JOHN DEWEY'S ECOLOGICAL NATURALISM

> In the old dispute as to whether a stag runs because he has long and slender legs, or has legs in order that he may run, both parties overlook the natural descriptive statement; namely, that it is of the nature of what goes on in the world that the stag has long legs and that having them he runs.
>
> - John Dewey[139]

> I regard the critique of biological determinism as both timeless and timely. The need for analysis is timeless because the errors of biological determinism are so deep and insidious, and because the argument appeals to the worst manifestations of our common nature. The depth records the link of biological determinism to some of the oldest issues and errors of our philosophical traditions – including *reductionism,* or the desire to explain partly random, large scale, and irreducibly complex phenomena by deterministic behavior of smallest constituent parts (physical objects by atoms in motion, mental functioning by inherited amount of a central stuff); *reification,* or the propensity to convert an abstract concept (like intelligence) into a hard entity (like an amount of quantifiable brain stuff); *dichotomization,* or our desire to parse complex and continuous reality into divisions by two (smart and stupid, black and white); and *hierarchy*, or our inclination to order items by ranking them in a linear series of increasing worth...
>
> -Stephen J. Gould in The Mismeasure of Man[140]

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139 John Dewey, *Experience and Nature,* in *The Collected Works of John Dewey* (Carbondale, Il: SIU Press, 1969), Vol. 1, Later Works, 210.

140 Stephen J. Gould, *The Mismeasure of Man* (New York: W.W. Norton & Company, 1996), 27.

## Introduction

This chapter takes as its main project the support of the following contentions: a gene centric understanding of the process of evolutionary change overemphasizes that genes are the unit of causal impact, and, as a result, a group of questions has emerged that are unable to be answered by the analysis of the isolated gene; the project of documenting the transfer of static units across lineages tells us little about the directional forces that lead to the transfer of those very same static units; the mere presence of genetic units across phenotypes and environments that abound with change and variation cannot be causally accounted for by an analysis of the content of the genetic units themselves; an exclusively reductionist and mechanistic analysis of genes has led biologists and philosophers of biology to neglect other salient factors in our explanations of the process of evolutionary change. Taken together the argument is a call to reevaluate the benefits and assumptions behind a viewpoint that starts from the whole, instead of that which starts with the pieces of the whole.

The gene-centered approach, even if successful in identifying a solitary unit that 'causes' the change, fails to explain much about the notable behavior itself. We can raise doubts about the wisdom of the gene centric position because of these failures, and a foray into an alternative method may be helpful in shedding new light on what is going on in any given biological setting. John Dewey's concept of growth will serve as a model for thinking about the relationships between organisms, and between organism and environment, that avoids some of the problems of the gene centric explanatory

methods, and can also absorb and include the advances in perspective that a gene centric viewpoint has provided.

The focus of this chapter is evolutionary change and the various methods, mechanisms, intuitions, and strategies that are taken to understand it. There are three main sections. The first section is a critique of what will be referred to as the gene centric view. This is not a critique of the merit of the function of a gene as a concept and term, but does critique a reductionist framework that places all hope for knowledge of the natural world on the identification of genetic material. This section will give acknowledgment to the many successes of the concept but will identify gaps in explanation that are created by accepting a dogmatic definition of the gene. The second section aims at addressing these gaps by way of exploring John Dewey's ecological philosophy of nature, which argues that these very gaps are of the utmost importance. The final section will attempt to propose a sort of unification, or at least a mutual non-exclusion, of these divergent ways of analyzing the biological world.

To further these ends, this essay takes as its main project the support of the following contentions: a gene centric understanding of the process of evolutionary change overemphasizes that genes are the unit of causal impact, and, as a result, a group of questions has emerged that are unable to be answered by the analysis of the isolated gene; the project of documenting the transfer of static units across lineages tells us little about the directional forces that lead to the transfer of those very same static units; the mere presence of genetic units across phenotypes and environments that abound with change and variation cannot be causally accounted for by an analysis of the content of

the genetic units themselves; an exclusive reductionist and mechanistic analysis of genes has led biologists and philosophers of biology to neglect other salient factors in our explanations of the process of evolutionary change. This critique is in no way denying the progress that has been achieved by the analysis of isolated genes. In truth, the view that will be described in later sections is not only not new, but is part of the view that was replaced by the rise of the gene-centric movement. The view in question, namely the thinking of the *naturphilosophen* and those inspired by them, went out of vogue in large part because of the overwhelming advances that molecular biology made. However, I argue, it may be time to reevaluate the benefits and motivations behind a viewpoint that starts from the whole, instead of that which starts with the pieces of the whole.

It has become a common methodology to approach novel behaviors and phenotypes by defining them based on the identifiable genetic underpinnings behind the emergent novelty. Simply put, if we want to know why one organism is slightly different then the technique recommended is to identify the unique allele or combination of alleles that are causing the variation of interest. This approach, even if successful in identifying a solitary unit that 'causes' the change, fails to explain much about the notable behavior itself. We can raise doubts about the wisdom of the gene centric position because of these failures, and a foray into an alternative method may be helpful in shedding new light on what is going on in any given biological setting. However, it seems prudent to question the merit and motivations of completely eliminating

imagination, forward thinking, and the like from the analysis of a phenomenon, namely evolution, that operates on a time line.

Chapter two presented Goethe's concept of the 'transcendental leaf' as a model for thinking about whole organisms that includes the relationships of development and changes across an organism's life-cycle. Chapter three introduced Schopenhauer's Will, which acting as a unified life force also allows for a non-reductionist method for examining and explaining evolutionary change. In a similar vein, John Dewey's concept of growth will serve as a model for thinking about the relationships between multiple organisms, and between organism and environment, that avoids some of the problems of the gene centric explanatory methods and can also absorb and include the advances in perspective that a gene centric viewpoint has provided.

The wider aim of the following discussion is the sketching of a synthesized perspective and a call to study, not just genes, but top-down relationships of organism, environment, and the gene. In order to pinpoint the areas of contention within the gene centric viewpoint that are going to be emphasized, a short, and selective, review of its historical maturation will be the starting point. During and after this discussion questions will be raised about the feasibility of a singular unit or type of unit that allows us to make deterministic predictions about the phenotype or behavior of the organism as a whole. The conclusion of the first section is that the prevailing definition of the *unit of selection* may in fact be hidden from selection forces and can little be understood as the primary cause of evolutionary change. Consequently, debates about its identity offer

little hope of providing meaningful explanations of the functional mechanisms of evolutionary change.

## The Rise and Use of the Gene Concept

By gene centric view I mean to include a large swath of theory that takes as its primary goal the identification of genes, gives intrinsic value to the measuring of the frequency of specific genes within a population across time, and the belief that in doing so a completed picture will gradually emerge that offers explanations for issues such as adaptation, behavior, speciation, and macroevolution on the whole. The particular focus of this review is on the rationale, defense, and criticisms of one of the strongest representatives of the gene centric view, the selfish gene theory. This brief survey will argue that the selfish gene is still one of the primary ways that biologists and philosophers understand the mechanisms of evolutionary change. Of particular focus will be the strangled language of the concept of identity of the gene that declares success and/or benefit based on dubious criteria. I will contend that doing so is a sort of Platonic and positivist hangover that still has credence, not because it does not have faults, but because it is heuristically and practically useful as a tool for clarifying phylogenetic relationships. This is not a new thing to criticize and when ecologists and philosophers of biology do so I am always reminded of Dewey's take on nature and wish that it was a well-known position because it would give unity and a rallying origin to the criticism. Dewey suggested that we do not solve problems, rather, we get over them. This problem, the result of reductionism, in the constant pursuit for the identities of isolated

things, lingers. Dewey also suggested that philosophy takes longer than most disciplines to let go of old problems, contemporary evolutionary biology is very much philosophical in this regard because it stubbornly holds onto extreme genetic reductionism. The viewpoint that will be proposed in the later sections of this chapter, drawing from Dewey's concept of Growth and from the previous discussion of Goethe's *Meamorphosis*, can be seen to further this pragmatic function, but does so without the problematic claims, explanatory gaps, and metaphysical baggage of the selfish gene theory and other gene centric views.

The term 'gene' has transformed drastically from its initial 1909 formulation by W.L. Johannsen who shortened the term from 'pangene' and whose original meaning was a notion meant to capture only function. For Johannsen a gene is:

> completely free from any hypothesis; it expresses only the evident fact that, in any case many characteristics of the organism are specified in the gametes by means of special conditions, foundations and determiners...[141]

Johannsen speaks of 'genotype' only as an aspect that is heritable, and 'phenotype' is the resultant product of the interaction of genotype and the environment.

One of the numerous debates that rose up after Darwin's 1859 publication of the *On the Origin of Species* was how does altruism evolve given the survival of the fittest rules of Darwin's natural selection. An altruistic trait is defined as one that is detrimental to the fitness of the individual that acts altruistically, but is beneficial to the group that contains members that have the altruistic trait. It is a behavior that is observed in a vast array of very different organisms and consequently probably arises by cause, that is, its

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141 W.L. Johannsen, *Elemente der exakten Erblichkeitslehre* (Jena: Gustav Fischer, 1909), 143.

occurrence is not a fluke. The two sides that emerged in this debate argued that selection either occurred on the organism level, as Darwin favored, or on the group level, which seemed more capable of handling altruism. Elliot Sober explains how the controversy revolves around the 'unit' or target of selection:

> If the organism is the exclusive unit of selection, then natural selection works *against* the evolution of altruism. If the group is sometimes a unit of selection, then natural selection sometimes *favors* altruistic traits. The units of selection problem cannot be settled by stipulate convention, because different views about the units of selection make contrary predictions about which traits evolve under natural selection.[142]

A third party entered when William's argues in 1966 that it is neither but the "meiotically dissociated gene."[143] This idea became central in what would become the units and levels of selection debate and in the rise of the gene centric position. In the 1970's Richard Dawkins popularized this position as he argued that the gene, rather than the group or individual, is the unit of selection because it alone is heritable.[144] Dawkins also introduced the concepts of "replicator" and "vehicle" to differentiate between genes and the organisms that, in Dawkins view, act primarily as carriers for the all-important units of selection, namely genes[145]. This particular debate has since been a lightning rod for distinctions and interpretations of the process that leads to the differentiation of new traits and species. Dawkins argues that this particular distinction was "foreshadowed"[146] by the embryologist August Weismann's germ plasma theory, first proposed in 1883,

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142 Elliot Sober, *Philosophy of Biology* (Boulder, Co: Westview Press, 2000), 91.
143 G. Williams, *Adaptation and Natural Selection* (Princeton, NJ: Princeton University Press, 1966).
144 Richard Dawkins, *The Selfish Gene* (Oxford: Oxford University Press, 1976, 2nd edition 1989). See pages 28 and 33 in particular.
145 Richard Dawkins, "Replicator selection and the extended phenotype," *Zeitschrift fur Tierpsychologie* 47 (1978): 61-76.
146 Dawkins, *The Selfish Gene,* 11.

which made a breakthrough distinction between cells in the germ-line and cells in the soma-line. According to Weismann, the germ line is solely responsible for the passing-on of the units of inheritance to the next generation; whereas the cells in the soma line make up all of the non-reproductive features of the organism, changes to these cells are non-inheritable and this limitation on soft-inheritance is known as the *Weismann barrier.*[147] The soma cells of the organism die and the germ cells, which are carefully separated and preserved throughout the organism's development to reproductive ability, are the seeds of the next generation.

Cartoonish characterizations of Lamarkianism capture the errors caused by a failure to make this distinction. Damage or changes to the somatic cells of the body such as appendages do not transfer to the germ cells of the body and consequently are not passed on transgenerationally. This is essentially the same type of argument that Dawkins is making, except that for his take the uninheritable soma includes all non-genetic material. The somatic line, or Dawkin's *vehicle*, is not considered a direct influence on the transmission of inheritable units. On the other hand, damage to the germ line, causes substantial damage to the next generation. Distinguishing germ-line replicators from somatic cells, or in Dawkins' language, "dead-end" replicators, Dawkins places primary evolutionary importance on the genes carried in the germ-line replicators because these genes are "the potential ancestors of an indefinitely long line of descendant replicators."[148] Dawkins argues that because it is only the genetic unit that is

147 August Weismann, *The Germ-Plasm: A Theory of Heredity,* trans. W. Newton Parker (New York: Charles Scribner's Sons, 1893).

148 Richard Dawkins, "Replicators and vehicles," ed. King's College Sociobiology Group, in *Current Problems in Sociobiology* (Cambridge: Cambridge University Press, 1982), 45-64, at 46.

"potentially immortal"[149] makes it the only candidate for the replicator. Genes are "the only units that actually survive or fail to survive."[150]

Dawkins arrives at the conclusion that the gene is the singular unit of selection, and that of primary evolutionary importance, because he asks the question what 'thing' is benefiting from evolution. In his understanding benefit means, essentially, survive. To be harmed then, following this line of thought, is to go out of existence. Using this as criteria, by looking back and observing the entities that have continued to survive unchanged we are able to concretely identify what evolution has benefited and what it has not. The upshot of this perspective is enormous as evidenced by the countless examples of homologous genes identified across vast distances of time and whose identities that have remained relatively unchanged through the divergence and speciation of species as remote as flies and humans. This system can allow us to perform tasks such as constructing phylogenetic trees that allow the tracing of lineages and provide justification for estimations of dates on divergence. These connections are able to be drawn because genes have not changed, or have not changed enough to lose their status as homologous. Dawkins then contends that what has changed is the organisms that 'carry' the genes and this should de-emphasize their place in our explanations of selection. Genes do not change and their identity survives indefinitely, and so they alone are to be considered the unit of selection.[151]

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149 Richard Dawkins, *The Extended Phenotype* (New York: Oxford University Press, 1982), 97.
150 Ibid, 97.
151 It should be noted that it has been strongly argued that gene selectionism does not really solve the altruism question that helped initiate this discussion. Elliot Sober suggests as much: "Again, the point to notice is that the longevity of genes does nothing to undercut the idea of group selection. Even if "genes are forever," this leaves open the question of whether altruistic genes evolve by

There is obviously a lot to be said in defense of Dawkin's position. The construction of phylogentic trees is a major industry that produces consistent and startling revelations of ancient connections, as well as providing clear separation in other cases. The almost infinite survivability of some genes is astounding even if only to inspire awe at the history of unbroken connection between the ancient organisms and the one's currently extant.[152] That being said, its cleanness and focus on that which has remained constant sacrifices too much by under-emphasizing the process itself of change. The story of evolution, and the path from the ancient to the contemporary, can only be understood by knowing what has changed and why it has changed. Consider any phylogenetic tree. It tells us that divergence occurred and that some populations are *somehow* connected by ancestry to others because of genetic similarity, and that there is a vague, yet definite, amount of time since they diverged. What can be said with this information about the prevalence of altruism, sexually selected traits, or any dynamic process? Can any meaningful probabilistic tendencies be derived? Is there one 'why' question that such a visual can answer? I ask these questions not to downplay the many achievements and uses of their construction, but only to suggest that unless the phylogenetic tree is layered within an account of contextual settings around the places of divergence they tell very little about why divergence has occurred.

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group selection." Sober, *Philosophy of Biology,* 105.

152 Christopher Janaway in *The Will in Nature* remarks off-handedly that Schopenhauer would have been fond of the selfish gene theory. I think that he is largely wrong in this contention but the indestructibility of the gene as it takes on different functions and roles in vastly different organisms across time is a concept that Schopenhauer might find compelling. However, the gene is not being selfish for its own sake, but for the sake of the life creation of more life that the gene acts as a facilitator for. That is, the selfish motivation of the object is Schopenhauerian, but what that gene is being selfish 'for' is not explainable under the reductionist model. It is absent of an explanation of want.

An oversimplified example may be found in the reading of a sports box-score. Reading that the final score of a sporting match was one to zero does not provide meaningful explanation of how this came to be. More importantly for the discussion at hand, in which philosophers and scientists alike are trying to be students of the game, the box-score tells us nothing about the rules of the game or about how it is played. The 'rules' and processes of evolutionary change are similarly not explained by identifying what genes made it on the 'scoreboard'. The discussion of Peirce's absolute chance in the following chapter does the work of providing a possible explanation for the origin and development of the scoreboard of genetics without necessitating an infinite dig into the past for the definitive causal origins of each genetic unit.

Within the debate over what units evolution is selecting, Richard Lewontin provides another valuable distinction by separating the units that are being selected and the levels on which the selection occurs.[153] Instead of merely stopping at the organism level or reducing to a single genetic locus, Lewontin entertains population level selection as well as multiple genetic levels. He concludes that the difficulties of understanding the levels of selection such as a "superorganism" are too great and notes that pleiotropy and epistasis create great hurdles on the genomic level. Maynard Smith has since popularized and defended the superorganism, and regulatory gene networks and linkage disequilibrium have been used to better understand the genomic levels on which selection can act. Although the larger and less reduced levels are more difficult to

153 Richard C. Lewontin, "The Units of Selection," *Annual Review of Ecology and Systematics* 1 (1970):1-18.

isolate, it is at these levels where the interconnectivity between organism and environment is maintained.[154]

Robert Brandon agrees with much of Lewontin's distinction. "…it seems to me that serious biologist and philosophers of biology have no choice but to take a hierarchical approach to selection."[155] Brandon proposes modules as the units of evolution. "Something is going to count as a unit or module of selection only if it, as a whole, serves a primary ecological function. "[156] In other words, Brandon is attempting to get around the problems that Lewontin illustrates by grouping larger pieces of the organism together. This increase in size of the unit being selected, going from gene to full organism, is in accord with the interconnectivity proposed by Dewey and Goethe that will be discussed later. Gene regulatory networks, and module selection, allow for an awareness of the relational properties and emergent features of combined elements of an organism. On the extreme other end is Dawkins selfish gene. Brandon contends that selection cannot simply act on one gene but must select on the emergent feature of the organism's phenotype, which is rarely, if ever, the result of a single genetic locus.

> What makes organismic selection organismic, as opposed to genic or group, is that it is the organismic phenotype that directly interacts with environment and so is directly exposed to selection. That is, selection in such cases cannot "see" the genes, it "sees" the organismic phenotype.[157]

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154 The connection between the superorganism literature, E.O. Wilson's defense of group selection and Schopenhauer's World-Will is related to this discussion but outside of the present scope.

155 Robert N. Brandon,"The units of selection revisited: the modules of selection," *Biology and Philosophy* 14 (1999): 167-180, at 168.

156 ibid, 174.

157 ibid, 171.

Another question that the gene-centric view has had great difficulty cleanly answering, as a result of the under emphasis on relations, is the actual physical size of the fully reduced and isolated unit. The two contending sides within this discussion are often characterized as either lumpers or splitters with the middle ground being a highly contentious and unsettled concept. [158] The extreme splitter runs into problems because if the unit is reduced all the way down to individual nucleic acids this doesn't help us understand function or how they come to code for different products in different situations. Lumpers have been gaining ground in this debate as work on linkage disequilibrium and gene networks has demonstrated that areas of DNA previously identified as genes are not by themselves units of inheritance because their function or contribution to the phenotype often requires many other genes and signaling networks working in concert. Recent research has suggested that selection on gene networks will tend toward sparsely connected and minimally complex networks,[159] which implies that the gene concept, if it is to retain status as sole unit of selection, needs to be broadened to include gene networks. Dawkins himself admits as much regarding 'lumper' gains and yet argues that his definition of the gene is unaffected by this. He suggests that, regarding linkage disequilibrium and networks, the "effective replicator will be a very large chunk of DNA."[160] Ernst Mayr,[161] Robert J. Gould,[162] and others have attempted

158 For a review of the early implications that Darwin had on splitting and lumping see: J. Endersby, "Lumpers and Splitters: Darwin, Hooker, and the Search for Order," *Science* 326:5959 (2009): 1496-1499.

159 R. D. Leclerc, "Survival of the sparsest: robust gene networks are parsimonious," *Molecular Systems Biology* 4 (2008): 213.

160 Dawkins, *The Extended Phenotype,* 89.

161 Ernst Mayr, *Animal Species and Evolution* (Cambridge, Mass: Belknap Press, 1963), 184.

162 Stephen J. Gould, *The Panda's Thumb* (New York: W.W. Norton & Company, 1980), 90.

to counter this position by arguing that selection acts "directly" on the expressed phenotype of an organism in a specific context and as a result only "indirectly" acts on the genome of the organism. Dawkins, undeterred, argues that this does not defeat genic selectionism because it is still the genes of the organism that get inherited and not the expressed phenotype.

The more recent evolutionary development literature differs in notable and important ways. For instance, theory regarding gene networks has made significant progress by focusing on the connections and relationships between individual genes and the creation of a phenotype. Gene networks are often able to trace an individual gene's contribution within a cascading series of genes that go into producing a phenotypic trait. It is well accepted that most phenotypic traits, including behavior and neural centered activities, are the result of small cumulative effects of many genes. In light of this, the proposition that gene networks are like houses of cards where the removing of just one causes the whole structure to tumble seems unlikely. Theoretical positions range from suggesting that each function in a network is assigned to specific genetic components to arguing that there is flexibility in the networks that can account for mutations, environmental change and potentially be an avenue for evolutionary change. R.H. Anholt discusses the ties between genes and behavior and argues that behavior is an emergent property of a system of networks that are composed of both hardwired innate elements and plastic environment sensitive components.[163] Similarly, the *developmental systems approach* acknowledges the conceptual challenges of an overly reductionist

163 R.H. Anholt, "Genetic modules and networks for behavior: lessons from Drosophila," *Bioessays* 26 (2004): 1299-1306.

account of nature.[164] Their work has moved away from the evolving unit being the gene and has instead worked to understand on the whole the developing system of the organism. This work is a step in the right direction as it is able to be flexible enough to allow for different functions and roles of genes, signaling molecules, and genetic networks at different stages of development. It has not only put the gene in time, but has uncovered the depth of relations and roles taken by structures across the life span.

One of the underlying tasks of studying development is identifying relationships that exist between gene products in the present or absence of other gene products. What is distinctly insightful about these discussions for the focus of this paper is that for certain genes to even begin to code there is often the requirement that the environment contains the appropriate signals, and often, the most crucial genes turn out to have the function of producing signals of initiation or cessation of other gene activities. The result is that the signals of a given gene are identified and then linked in association to other genes, which are invariably related to still further genes and yet again to even more far-reaching associations. It is an improvement from the static reductionism of the selfish gene as it has included the notion of time and of different functions for genes in an organism's life history. The areas between reduced units of the organism, the organism as a whole, and the external environment appear to contain necessary and constant connections that doom the project of hierarchically labeling one as fundamentally primary for evolutionary change.

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164 See for example, P.E. Griffiths, "Genetic Information: A Metaphor in Search of Theory," *Philosophy of Science* 69 (2001): 394-412.

Even if a satisfactory answer could be agreed upon for the question of the size of the reduced unit (whether it be an individual gene, gene network, module, etc) this says very little about the actual *cause* of the survival and transgenerational success of the genome in which it is embedded. It is also interesting to note that the larger the physical size of the reduced unit there is a corresponding need for more to be said about the interactions between the moving parts to explain the function. An individual nucleic acid is clean and concrete, but there is nothing much to say about what it does unless you put it in context with other components and explain how those components 'talk' to each other. On the other hand, even some of the most well understood regulatory gene networks have complicated pleiotropic contingencies that are not well understood. Regardless of the actual size of the unit or level of selection, whether it is a gene or a population, survival and reproduction do not occur in a vacuum, and without knowing the external conditions in which the evolutionary success is achieved it is not saying much to say that a particular gene 'benefits' from evolution.

The criticisms of an overly reductionist philosophy of biology are not new, are by no means universal, and have many dissenters. Another example of the move away from the gene centric viewpoint can be seen in David Hull's introduction of the distinction within the replicator debate between "replicator" and "interactor". [165] Replicators simply reproduce themselves and may have no phenotypic expression. Hull claims this is a different function from interactor units that do contribute a substantive effect to the phenotype of the organism in which they reside. In this way, the interactor

165 David L. Hull, "Replicators and Interactors," In *Science and Selection* (Cambridge: Cambridge University Press, 2001), 13-32.

alone is subject to selection forces. If the difference that it makes in the phenotype produces differential survival/reproductive results then the interactor unit is subject to natural selection. The concept of interactor is helpful to this discussion because it includes within its scope of relevant factors the interaction between organism, the organism's suite of traits, and the environment. Elliot Sober also supports this distinction and contends that the units of selection problem "is about interactors, not replicators." He contends that to say that *only* replicators are important cuts out too much. "Selection processes require items that transmit their structure relatively unchanged from generation to generation (replicators) *and* things whose interactions with the environment affect their survivorship and reproductive success (interactors). Even if genes are replicators, whereas organism and groups are not, the question remains open as to which objects are interactors."[166] The interesting and challenging questions about the connection between genotype and phenotype occur when behavior, specifically behavior that is relevant only in a specific environment, is considered an aspect of the phenotype. Dawkins in *The Extended Phenotype*_ goes as far to include such things as the beaver's dam in his definition of the beaver's phenotype. This extension falls in line with the continuity of nature proposed by Dewey. Plants lack such behavioral complexity, and yet developmental possibilities and limitations occur throughout the organism's growth. It is at these levels where Goethe, Dewey, and Arber's emphasis on interconnectedness within the individual is helpful. Schopenhauer provides the impetus for the initiating behavior and the next chapter's discussion of Peirce's concept of

166 Sober, *Philosophy of Biology,* 104.

absolute chance argues that the process is not deterministic. Taken all together there is an ecological interpretation of nature that is non-deterministic, non-reductionist, and offers an explanatory method for behaviors and phenomena that are unable to be accounted for on the current paradigm.

Despite these criticisms of Dawkins' selfish gene, it is a common, and yet problematic, practice to associate the cause of interactor success with the fitness of replicators. Epistatic effects are often considered to be the exception to the rule. Of particular interest for this discussion is the ability of the interactor concept to account for the idea that many genes and their emergent properties remain latent and consequently are unable to be targets on which selection can act. This will be discussed more fully in the next section.

The problems of the gene-centric view are numerous and the ones that have been so-far discussed have only been chosen because they fall within the scope of this discussion of an under-emphasis on relations being detrimental to the task of understanding evolutionary change. For the most part, recent philosophy of biology discussions have side-stepped the question of the actual identity of the unit of selection and have ceased demarcating between replicator and vehicle. A weariness with the question itself can be seen in statements such as, "Once the possibility of many, equally adequate, representations of evolutionary processes has been recognized, philosophers and biologists can turn their attention to more serious projects than that of quibbling about the real unit of selection."[167] And yet, problematically, the terminology and

167 Philip Kitcher, Kim Sterelny, and C.K. Waters, "The Illusory Riches of Sober's Monism," *The*

metaphysical assumptions about unified identity and the gene have become entrenched. The move away from the replicator debate has resulted in the strained adoption of a hierarchical view of the gene in which the definition of the gene itself remains unclear, but still advances arguments on the *belief* that, if all the facts were in, all evolutionary changes could be explained by a change in gene frequencies.[168]

The preceding review is by no means exhaustive and was intended to depict a concept, the gene, that despite its wide acceptance has had to withstand theoretical contentions to its meaning and place within the landscape of biological explanation. It is this role as explanatory tool that will be evaluated in what follows. There is no doubt that genes are essential to understanding and tracking evolutionary change. What is at issue here is the primacy of their role and the ability they have to say anything meaningful about the process of evolution itself. A reduced identity of a singular gene is essential to two processes. They are needed in identifying the relationship between other genes in a developing organism, and for tracking of the consistency of inherited structures across generations. Separating these two limited roles for genes from other essential questions about evolutionary change will go far in helping to distinguish between situations in which it is irresponsible to accept gene frequencies differences as explanations that can fully capture the entirety of an evolving system.

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*Journal of Philosophy* 87:3 (1990): 158-161, at 161.

168 For further discussion see: Kim Sterelny, "Explanatory Pluralism in Evolutionary Biology," *Biology and Philosophy* 11:2 (1996): 193-214. C.K. Waters, "Tempered Realism about the Force of Selection," *Philosophy of Science* 58:4 (1991): 553-573.

## Theory Reductionism and Genes

The following three sections aim to further develop some specific critiques of the gene centric position. The gene centric viewpoint is often seen to be avoiding many of the sparsley supported and inconclusive conclusions of other fields such as archeology, psychology, anthropology, etc. Genetics is considered to provide a clean, unassuming, project that involves little to no guesswork. The *assumption* is that gene can be identified and isolated and the *hope* is that the combined work of researchers over enough time can gather all of the pieces and connections and something real will emerge. Genetics, as instanced by the continuing excitement around genome sequencing, has a guiding hope that the whole picture will become clear by itself. Underwritten in these hopes for a future where-all-the-information-is-in are metaphysical assumptions about the possibilities of complete knowledge regarding scientific realities. Although these unknowns cannot, by definition, be conclusively supported or disproved, it is still an intellectually honest procedure to question and identify the areas where confidence is placed on uncertain grounds.

A similar strategy can be found in the familiar idea of theory reduction, which contends that there are universal laws and theories, like those thought to exist in physics and chemistry, to which all disciplines can eventually be reduced. Similar metaphysical beliefs about reality also appears to be what is driving much of the genic project. Ernst Mayr, in particular, is a critic of this approach to biology:

> Attempts to "reduce" biological systems to the level of simple physic-chemical processes have failed because during the reduction the systems lost their specifically biological properties…All authors in recent years who have studied

> this claim, including even several former reductionists, have come to the conclusion that such theory reduction is virtually never successful.[169]

Further questions about the wisdom of the pursuit of a unified reductionistic theory in something as fluid, and all together messy, as Nature should be raised considering that the same process in modern physics has been, for the most part, abandoned. The LaPlacian Demon, and hard determinism, have not found empirical support in physics, and yet it seems that the spirit of classical mechanics resides in some of the ways we think about evolution.

Another dimension that causes confusion when thinking about genes with the assumptions and hopes described above is the apparent duality of denying telos to natural selection but describing genes as survivors that carry with them, and are given identity by, specific information. Defining genes as 'selfish' and as the sole survivors of evolution suggests an intentionality that, for the sake of clarity, should be isolated and separated from the distinctly unintentional forces of selection. For instance, Francis argues that defining genes as intentional carriers of information that have a teleological function is "spooky.[170]" Francis suggests that when informational concepts like 'the gene is the unit of selection' are placed at the center of our conception of a process the result is unstated assumptions that influence the conclusions. Information is non-material, and as a result, conceptions of the gene as the carrier of that information between generations relies on a non-material identity. Consequently, when defining the gene it is important

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Ernst Mayr, *Toward a New Philosophy of Biology: Observations of an Evolutionist* (Cambridge, MA: Harvard University Press, 1998), 1.

170 R. Francis, *Why Men Won't Ask for Directions: The Seductions of Sociobiology* (Princeton: Princeton University Press, 2003).

to separate its function as a piece of information from its status as a reduced piece of physical property. For example, it is often the case that the same physical gene, executing the same code, provides information in many different environments and situations throughout the development and life of an organism. The physical gene is identical but the information that is being received and translated in different situations performs radically different functions. The signaling ligand *Sonic Hedgehog* for instance is essential in both the development of the limbs and the brain. The products and functions of each environment are drastically different and yet the physical reducible identity of the *Sonic Hedgehog* protein is identical.

Considering all of this, it seems apparent that the pursuit of the identity of the unit of selection and gene is a pursuit that is asking the wrong question. In many senses the isolated unit would be unverifiable because to know what identity is as a specific unit we would have to put it in the context in which it performs the function that allows us to ascribe an identity to it in the first place. The 'why' and 'how' answers in evolutionary theory are not likely to be found in isolating the string of amino acids that has persisted, rather, it requires that we also include an evaluating of the functions instrumentally performed by the always-intertwined units.

## Causation Explanation and Latency

This section will argue that the explanation of how evolutionary change occurs requires more than is immediately available from the reductionist project. A particular focus will continue to be the metaphysical assumption that the collecting and naming of

various sections of the genome is the essential project necessary to unveiling the inner workings of an organism. Also, a second recurring subject is the aim or hope that the identification of the moving parts will reveal insight into the rules that guide the motion. In order to do so, the concept of latency, as well as the role that teleological thinking plays in explanation, will be discussed.

The identification of a gene as a substance, by any definition, requires that there is something able to be said about it. One way to explain a gene is to say what function it contributes to, or to say that it is somehow involved in the creation of another identifiable product. In so doing, we are discussing the motion from potential to actual of the latent properties inherent in the gene. The Medieval idea of a latent property is that property which belongs to a substance but only expresses itself under a certain situation. For example the fragility of glass is a property that only expresses itself under specific contexts. For the most part, the property is not expressed, hidden or, one could argue, absent. If we take this example and apply it the explanation of evolutionary change and use it to identify the causal chain behind it, there emerges awkwardness for the gene centric method.

The ability or power of the activity of a single gene to contribute to the production of a phenotype or to pass on information to the next generation rests on the necessary condition that the appropriate situations be present for the gene to perform, are present at the right time and location, and have the necessary supportive gene products and resources available afterward. Genes code for amino acid sequences of protein molecules and this is a step in an explanation of the cause of evolutionary change, but to

eliminate the environments contribution is to truncate the causal pathway. Take for example the common situation in which a population that is in undergoing a context change expresses phenotypes and behavior that were not expressed under the previous conditions. So-called 'junk DNA' has been shown to contribute more than previously thought, but it can safely be said that there are large amounts of genetic material and latent but inactive gene products in any organism. If a latent gene is not contributing to the incarnation of an individual organism it is tough to say what exactly it is doing, if anything. If the situation does not arise in which it plays a role, but it still survives indefinitely within the gene pool, how exactly does identifying, naming, and isolating it contribute to our understanding of evolutionary change? If it does survive for a long period of evolutionary time but has no phenotypic effect, then it could be said that it has done so because it is only a byproduct. If the difference between the expression of one gene over the next is the conditional setting of the environment in which that gene is contexted; and the 'cause' of indefinite survival of the gene is the contexted expression of one phenotype over and above the expression of countless others that remain latent in the genome's possibilities, then the causal power that determines the survival of a gene is largely the result of the context of the genome. Consequently, the identification of the gene as somehow primary and of greater hierarchical value under appreciates the latent but unexpressed possibilities of the genome. Taking this further, if there are many known 'causal' relations involved in the formation of a product (organism, trait, function, module, etc) then denoting one as primary is an arbitrary assignment. Even if it is only given status as the first process, if there are forks along the developmental road

that the initiator is involved in, saying that the final product is ‘caused’ by the initiating event is a mistake as it could have been otherwise if one of the other alternative forks had been taken.

Again, this is not a new critique. Echoes of this distinction can be found in the bookmarking critique of genic pluralism, first broached by William Wimsatt.[171] The idea of the bookmarking critique is that identifying genes as the signaling unit that mark a difference, either an entry or an exit, of change in a population fails to explain the 'how' of the causal process that results in a difference. Similar arguments have also been made outside of the bookmarking argument. Griffiths argues that causal factors are almost always context dependent in complex systems and also argues for the necessity co-presence of genetic structure and the appropriate context for that genetic structure. For Griffiths, causes resulting from genetics will only be considered ‘normal’ if the appropriate environmental trigger is present, but conversely, the causes associated with the environment will only occur if the suitable genetic underpinnings exist in an organism.[172] For example, an organism will withdraw from death inducing heat only if it has the genetic structures to receive the input and react, and the genetic structures that produce the behavior of withdrawing from extreme heat will only be initiated if such heat occurs in the organism's environment. As a result, the cause of the behavior cannot be fully defined as either the genome or the context, but in the relational interaction of the two.

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171 William C. Wimsatt, “Functional Organization, Functional Analogy, and Functional Inference,” *Evolution and Cognition* 3 (1997): 2-32.

172 Griffiths, “Genetic Information: A Metaphor in Search of Theory,” 395.

The highly celebrated Sonic Hedgehog gene is marvelous as model gene because of its ancient origin, occupancy in vastly different phenotypes, its multiple functions and varied times in development across many corporeal regions. The gene is crucial in a highly conserved and evolutionarily ancient mechanism that sets up the symmetrical formation of body patterns. Also intriguing are the disastrous phenotypic effects that occur to individuals that have disruptions in its work. We know that it is ancient because similar variants of it are found in organisms as diverse as humans and the fruit fly *Drosophila Melanogaster*. However, to simply say that *hedgehog* causes humans and D. *Melanogaster* says very little about what it is to be one of these organisms. Isolated it provides little understanding. Only in understanding its role within genetic hierarchies and status as a signaling switch within a series of cascading effects do we know what exactly it *does.*

## The Taboo of Purpose/Function Talk

It is often considered panglossian to ask questions such as what is Sonic Hedgehog for, what is its purpose? However, much of experimental genetics involves observing effects of timely knockouts, or observing the place and timing of the expression of genes - all the while using something very much like 'purpose' as a compass pointing towards what to test next. For instance, one might discover that Gene X is expressed in location A during time R but not time S. What does this tell us? The scientist is most certainly asking purpose driven questions if the next experiment done is to repress the expression of X during R and to observe what effects this produces on the

phenotype. However, it is still thought dangerously presumptive, even with a dramatic conclusion, to suggest that gene X has a specific role in the formation of an organism. This hesitation is made for many good reasons. Despite these perceived dangers there is still a wish in hypothesis formation to be able to talk about purposivity, even if it is required that it is ground in mechanistic jargon.

This purposivity and its dangers can be seen in Aristotle's four causes or explanations. Of particular importance are the efficient causes, defined as the prior factors that contribute to the cause in question. Following the emphasis of the discussion above on both genetic underpinning and environmental context we can identify both as efficient causes. Of particular concern moving forward is the final cause which is said to be the future state of affairs that somehow can be seen as reaching backwards in time and bringing about the cause in question. The teleological thinking implied in the idea of the final cause is fraught with problematic implications. Aristotle's final causes have been for the most part discarded because of their teleological attempt to make statements about future events. One good reason to worry about them is that final causes do not display the proper amount of humility regarding how much we know about future events and also, by some, has been seen to imply a knowable, anthropomorphized source behind the teleological direction. Newton's mathematical approach to natural philosophy is often held up as the end of the discussion for final causes.

Classical mechanics in many ways offers a replacement for Aristotelian thinking that removes final causes from inquiry and places them outside of the concern of science. For instance, the actual 'cause' of gravity is not Newton's concern, only

describing the proportions of the universal effects on bodies with mass. Yet, Newton did not completely remove himself from Aristotelian thinking. The laws of motion including the Law of Thermodynamics, when placed in time, make predictions that can be used to make causal claims about the future, and can be used to explain the present by activities that occurred in the past. For example, if a gas is dispersed in the corner of a room the prediction is that over enough time it will evenly distribute itself throughout the room. This prediction of future events can be confidently made because there is a known future condition and this helps us to understand what happens in the present. Knowing the kind of gas molecule, and the medium in which it begins, informs us of information such as the time it will take to fully disperse. Knowing the efficient cause is important, of course, but the causal explanation of the Law of Thermodynamics takes shape only in light of the known final state informing the process that leads to it.

When it comes to the causal explanation of evolutionary change there is, of course, no known end state such as the dispersal of gas in a static environment. Knowing only the efficient cause, namely the genomes of populations and the environmental context of those genomes, does not fully capture the interesting parts of the cause of evolutionary change any more than knowing facts such as helium, 5 foot enclosed box, and 20 minutes would causally explain what we would expect to occur. Causal explanations require that we put the whole thing on a time scale, including hypothetical predictions of future states. Discussion of final causes often raises suspicious eyebrows when applied to evolutionary change, and rightfully so. However, it can be, and often unspokenly is, a useful tool. It is difficult to see what kind of a role

this type of thinking could possibly have in a reductionist and gene centric view. It is in this inability to do much other than sort and name that a more robust description of process in biology will be helpful.

## The Concept of Growth in Dewey's Ecological Approach

Dewey and Goethe are both evolutionists of a different mold, and both emphasize an inclusive and distinctly non-reductionist conception of nature. For Dewey it is the relations and the falling in and out of harmony with the changing and challenging environment that is of interest. For Goethe's conception of nature the interest lies in relations within the organism itself, particularly during development and metamorphosis. A brief look into these two thinkers emphasis on the process of the moving parts, rather than the identity of the parts themselves, provides a contrasting view that largely avoids many of the problems of the gene centric viewpoint discussed above. A particular focus of the discussion will be a questioning of the wisdom of the backlash against teleological thinking that followed Darwin. Within Dewey and Goethe's systems there is a type of teleological thinking that includes growth and development towards something, but which denies that the *something* is an absolute. The aim of this section is take further the implications of an ecological understanding of context without excluding the merits of the gene concept.

John Dewey's 1910 essay *The Influence of Darwin on Philosophy* contends that Darwin has introduced a new logic into philosophy that takes seriously the transitions and development occurring as a result of variation and the ensuing struggle for life

between and among those variants.[173] Dewey also holds that Darwin has put a conclusive end to much of the teleology based interpretations of nature's divine purpose and direction. The result is an open ended future that allows for the possibility of creativity, purposive accord with nature, and, conversely, the antagonistic possibility of disconnect and destruction for all species, including humans. Dewey contrasts the "new intellectual temperament[174]" of Darwinism with the traditional philosophical notion of nature in which ideas and species are understood in terms of a "fixed form and final cause[175]" that is immutable. The temperament of impermanence and change that Dewey's plasticity suggests is at the core of the Darwinian turn, and yet surprisingly and markedly, is not found in the 'immortality' of Dawkins' gene or in most variations of reductionism and a gene-centric view. The implication of this is that either Dewey was off in his interpretation of the consequences of Darwin or there is a lingering reminiscence of the "fixed form and final cause" metaphysics in evolutionary stories that tell only of the unchanging and immutable protagonist of gene frequency change. In contrast, Dewey supports an interactionist understanding of Darwin's natural selection that includes meaningful impact as a result of learning, plasticity, and the volatile situatedness of life.

The aspect of Dewey's philosophy that will be relied upon for this discussion is his concept of *growth.* Dewey's attempts to take the lessons learned from the evolutionary discussions of his time and apply them to philosophical, aesthetic, political,

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173 John Dewey, *The Influence of Darwin on Philosophy: And Other Essays in Contemporary Thought* (New York: Holt, Rinehart and Winston, Inc, 1910).
174 Dewey, *The Philosophy of John Dewey,* 35.
175 ibid, p 32.

and pedagogical issues of his time. Jerome Popp (2007) makes the argument that Dewey was the first thinker to seriously accept and apply the implications for philosophy of Darwin's transformative understanding of nature. The pre-Darwinian mind-body distinction embraced by many philosophers (even some Neo-Darwinians*)* and the theory of natural law are rejected by Dewey. The only "natural law" is natural selection, the enforcer of the "right" kinds of growth.[176]

Much of Dewey's discussion of 'growth' came in the context of education, but the analogy holds. For Dewey, the species and the student face the same external pressures – for either of them, "As long as it is growing, the energy it expends in thus turning the environment to account is more than compensated for by the return it gets: it grows…Life is a self-renewing process through action upon the environment."[177] The connection between life and growth is not a suggestion about the good life or any other casual rumination about improvement. Growth is a necessary process for any living thing or group of things, without it there is increasing discord ending in death and/or extinction. Growth is acting to keep us above the lower limit of existence, and it is a struggle that no single individual is able to maintain indefinitely.

> After a while they succumb; they die. The creature is not equal to the task of indefinite self-renewal. But continuity of the life process is not dependent upon the prolongation of the existence of any one individual. Reproduction of other forms of life goes on in continuous sequence…As some species die out, forms better adapted to utilize the obstacles against which they struggled in vain come into being. Continuity of life means continual readaptation of the environment to the needs of living organisms.[178]

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176 Jerome Popp, *Evolution's First Philosopher: John Dewey and the Continuity of Nature* (Albany: State University of New York Press, 2007).

177 Dewey, *The Collected Works,* Vol. 9, Middle Works, 4.

178 ibid, 4-5.

Dewey's understanding of nature includes a constantly evolving trajectory, as the environment changes the definition of what it is to be well adapted and adapting individual changes to suit it. The connection between growth and education is more than analogy for Dewey. Dewey defines education as a "continuous process of growth, having as its aim at every stage an added capacity of growth."[179] Within this definition is a Darwinian informed conception of adaptation that offers growth as the vehicle for becoming sufficiently adapted. He warns of an 'educational extinction' that is possible if an individual ceases in progressing and becoming an adaptive student and maintains a developmental trajectory that is in stasis and fails to listen and adapt to the changing contextual demands. The application of this view of nature to education has been a primary way that Dewey's evolutionary theory has been applied. That being said, I contend that it needs to be reapplied to our understanding of nature – what was once taken almost as a given for Dewey has been forgotten. The application of the theory was Dewey's concern, but the theory has grown an ulcer and needs to be revisited. In short, the Deweyian sketch I am presenting is itself paradigmatically distinct from a gene-centered view of evolutionary change and much insight can be gained, I think, from inserting Dewey's understanding of Darwin back into the thought of contemporary evolutionary biology.

The interaction of organism and environment is pushed to the forefront in Dewey's concept of growth. This contrasts with the interactor/replicator debate by contending that the issue of import is the closeness of the interaction between all of the

179 Dewey, *The Collected Works of John Dewey*, Vol. 9, Middle Works, 59.

moving parts of organism and corresponding environment, rather than an issue of giving primacy to the individual part that contributes the 'most' to evolutionary success. Nature has a flow to it and the organism is interconnected and responsive to the environment to such a degree that Dewey melts the clear separations such that the two become continuous. Growth is that which is exhibited by something that is becoming more connected and responsive to the needs of the situation, and death is what occurs in its absence. Rather than looking at the causal relations between the moving parts Dewey redirects us to the totality of the organism's entire history. Consider the following passage from *Experience and Nature:*

> The reality *is* the growth-process itself…The real existence is the history in its entirety, the history as just what it is. The operations of splitting it up into two parts and then having to unity them again by appeal to causative power aer equally arbitrary and gratuitous…To give the traits of either phase a kind of independent existence, and then to use the form selection to account for or explain the rest of the process is a silly reduplication...[180]

Think here of Zeno's paradoxes, if we can always break it up into smaller parts it clashes with the undeniable empirical reality of the moment, and, in this case, fails to explain evolutionary change. One way to do a Deweyian analysis of a contexted setting begins by a search for the innate *tendencies-already-present* in an organism. This is significantly more than the presence of the proper DNA. It identifies a functional activity of the organism as the starting point. Instances abound, for example: the ability of a spider to almost intuitively spin a web, a human to learn language, the female swordtail to have a beneficial preference, the male Redback spider to have suicidal

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180 Dewey, *The Collected Works of John Dewey,* Vol. 1, Late Works, 210.

tendencies, and so on. Admittedly, these behaviors may have a genetic underpinning, but they are only explained and understood when put into a context, when the function is expressed in a context in which that function's tendency already present has purpose.

Consider the analogy of the study of human genealogy and a phylogenetic tree. T.C. Dalton suggests that the public debates over evolutionary theory that took place between Darwin, Huxley, and Samuel Butler influenced Dewey to put forth his own explanations for apparent adaptations, such as those suggested within the *tendency-already-present* analysis.[181] Organisms often have an easily observable (and easy to misinterpret) readymade ability to fit into the environment in which they are placed. The act of outlining this 'fit' gives an idea of the connection between organism and environment. Language of 'fit' and 'purpose' is often considered Lamarkian, but if supernatural telos is removed and a more robust concept of constraint driven teleology is implemented, particularly as it is found in Dewey's concept of growth, insight might be gained into the questions of epigenetic changes that are driving current neo-Lamarkian resurgence. The potential of this tendency is vast, and the ice fish with their extreme phenotype of bloodlessness represents this well. As human observers we can't help but analyze the continuity of experience between these tendencies and the situation. This analysis allows the observer to postulate areas of potential growth, past and present. This analysis is not limited to early life but at every stage in the development of life, human and otherwise, as in many contexts behavior is exhibited that suggests a *tendency-already-present*. The result is the interplay between the fixed aspect of an

181 T.C. Dalton, *Becoming John Dewey: Dilemmas of Philosopher and Naturalist* (Bloomington, In: Indiana University Press, 2002).

organism's instinct and a plastic behavioral modification that comes from interaction with external pressures. As human observers we can't help but analyze the continuity of experience between these tendencies and the situation. These continuities are essential, as they provide a way to look at organism and environment without having to dissect the two, and their various parts, into distinct pieces. Dewey felt that there was great value in understanding these relations as they provided insight into the organism and the environment that scrutiny of discreet parts fails to capture.

Dewey's 'growth' captures his commitments to both a non-teleological and yet non-reductionist naturalism. There is nothing that the organism, population, or species are growing towards, just the movement of growth. "[I]n reality there is nothing to which growth is relative save more growth..."[182] When we think about the interaction of evolving population and environment there is the common mistake of focusing on the outcome of the evolutionary process. Contemporary biology research publications occasionally devote a small section at the end devoted to tentatively asking: "given the empirical results I have just presented what can I say about where everything is tending?" Or more generally, "What do the different rates, significant statistics, and well constructed graphs reveal about what has been important for the 'development' of the ancestral state to the present one?" The image here is of movement toward something new and away from something in the past. It relies upon the assumption of a ladder like hierarchical system that treats phenomena such as evolutionary reversals as a step down the ladder and a setback due to a lack of proper motivation from the environment. This

182 Dewey, *The Collected Works of John Dewey,* Vol. 9, Middle Works, 56.

is problematic and Dewey successfully avoids it. In contrast, Dewey in the essay "Preparation, Unfolding, and Formal Discipline" contends: "The conception that growth and progress are just approximations to a final unchanging goal is the last infirmity of the mind in its transition from a static to a dynamic understanding of life."[183] In other words, understanding genes as hierarchically more valuable in a pre-constructed game, that we are trying to learn the rules of, is a misunderstanding of some of the most profound implications of Darwin's work.

The interpretation of Deweyian growth so far discussed focuses primarily on something like positive growth, but in light of the lack of hierarchy within Dewey's concept of growth more should be said about the lack of a teleological end for evolutionary change. The needs produced by living thing's surroundings change, and accordingly, the direction and scope of the growth of the individual must change or perish. This, in short, is an attempted explanation of the 'why' of evolutionary change. Popp explains further: "The only standard in existence for the growth of these organisms, whether in numbers or genomic modifications, is the capacity for more growth. Natural selection weeds out individual organisms and whole species that cannot maintain that capacity."[184] In this way, the surroundings of a population are not a variable to be considered, but an extension of the organism. Much of Dewey's applications of this concept were directed at human endeavors and the concept appears over and over again in his political, aesthetic, and educational writings. However, the

183 Dewey, *The Collected Works of John Dewey,* Vol. 9, Middle Works, 61.
184 ibid, 81.

impetus of survival applies to all biological life. As Sydney Hook said of Dewey's concept of growth:

> Man is as authentic a part of nature as other things which have careers in time, but he is a part of nature which, to keep its very equilibrium and to remain alive, must enter actively into the processes that condition its very nature. Man must grow with the things which challenge him in this contingent and dangerous world or else he dies. [185]

The direction of growth is aimless but the purpose, if there is one to be found, is a more perfect unity with the needs of the surroundings of the individual. It is in this vein that Dewey adds to the discussion at hand. Understanding the individual as separate from, or in combat with, the environment is to mistakenly deny the interwoven connection between the two. This is, of course, not a new element to evolutionary thinking, as Darwin can be read to have emphasized as much:

> In looking at Nature, it is most necessary to keep the foregoing considerations always in mind – never forget that every single organic being around us may be said to be striving to the utmost to increase in numbers' that each lives by a struggle at some period of its life; that heavy destruction inevitably falls either on the young or old, during each generation or at recurrent intervals. Lighten any check, mitigate the destruction ever so little, and the number of the species will almost instantaneously increase in any amount.[186]

The concept of fitness is not hierarchical, but more closely is represented by Dewey's notion of a harmony with external pressures. Despite the lack of newness to the theme of 'organism in context', much of the discussion that originally surrounded its implications has since gone mostly quiet – while the unstated acceptance of genetic reductionism has become more deeply ingrained in the public psyche.[187] This is in part a

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185 Sidney Hook, "John Dewey--Philosopher of Growth," *The Journal of Philosophy* 56:26 (1959):1010-1018, at 1014.

186 Charles Darwin, *On the Origin of Species* (New York: Gramercy Books, 1979), 119.

187 Consider the recent fervor over the isolation of a hormone related to monogamous behavior in voles.

result of the fascination with the clean Mendelian answers that are overturning the work of millennia of Aristotelian inspired division of species using only observable phenotypes. What has been lost since Dewey's application of Darwin is that the intuition behind the rational for the Aristotelian and Linnaean connections was relational and required analysis of potential connections. The procedure of running the data through a program or equation is not likely to last because the equation-influenced data that results from the algorithm will consistently fail to answer the explanatory questions that originally inspired the Aristotelian classification system. That is, why do things change, or maybe better, how are they *functionally* different. Of particular interest to the original debates that Dewey was concerned with was the origin of new functions and traits of an organism.[188] Huxley in particular had concerns because the appearance of a new trait and its function are not necessarily one and the same. Dalton supports Huxley's critique, "Darwin easily could have confused the difference between potential functional capabilities of a phenotype that require experience for their complete expression and those which involve irreversible genetic modifications that are not subject to further functional modification."[189] Lost in this discussion is the possibility that plastic abilities of the organism remain dormant in some contexts and not others. Mendelian origins for new mutations that can then be selected for does provide some explanation for the origin

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Heather E. Ross, Sara M. Freeman, Lauren L. Spiegel, Xianghui Ren, Ernest F. Terwilliger, Larry J. Young, "Variation in Oxytocin Receptor Density in the Nucleus Accumbens Has Differential Effects on Affiliative Behaviors in Monogamous and Polygamous Voles," *Journal of Neuroscience* 29:5 (2009): 1312-1318.

188For more information see: T.H. Huxley, *Evolution and Ethics and Other Essays* (New York: Appleton and Co., 1896).

189 Dalton, *Becoming John Dewey,* 34.

of new material for selection to act upon, but the actual functionality of any new trait requires the purposive concord of organism and context.[190]

## A Deweyian Revisioning of the Reductionist Paradigm

This brief review of some of the aspects of Dewey's philosophy of nature was not meant as a direct push against the reductionistic paradigm but rather as example of a view of nature that considers relations in a meaningful way that does not attempt to give them permanent identity as reified units and gives them a substantive role in the explanation of change. A full description of evolutionary change should attempt to account for both the Parmenidean 'immortal' identity of genes as well as the Heraclitian transitional process that is seen in the diversity of living things. Naturalists and geneticists, or ecologists and molecular biologists, don not often read the same articles, and if they do they do so in an entirely different way. Arber suggests a specific intermediary role for naturalism: "There is much to be said for the suggestion that, whereas *Metaphysics* studies 'being' as such, and *Natural Science* (of the physico-chemical type) treats of the corporeal world, *Natural Philosophy* may be so defined as to link the two; it would then connote that mental activity which ceaselessly weaves connexions between the planes of intangible 'essence' and tangible 'existence'."[191] Both projects have a Don Quixote-like doomed and yet heroic approach to Nature. On one hand there is the attempt to understand in whole the complexities of Nature by piecing

190 Connections to this concept abound in the next chapter's discussion of absolute chance and habit-taking

191 Arber, *The Mind and the Eye,* 125.

together its smallest parts, and on the other hand, there is the attempt to understand individual parts from only after they have been situated within the wholeness of Nature.

Classical taxonomy of the Aristotelian sort, for example, looks at characteristics of specific body parts such as the length of a tail. The exalted revolution that has occurred is that we can look at just the "numbers" of genetics and avoid the errors caused by mislabeling such as the famous example of 'squished tails' resulting in new classification of species and other subjective mistakes. There is value in this. The question that should be asked of every exalted solution is does it actually solve the problem that it claims to. In other words, does it work? In the case of genetics, there have been many cases where the answer is yes, it does work. Phylogenetics and other tools of the gene-centric paradigm avoid the mistakes and flaws of the Aristotelian methods caused by things such as the subjective measuring of tails and the guessing at degrees of relatedness. What is the cost though? Does it work? Does it do the job? The function of phylogenetics, it could be argued, was to establish relatedness and between diverse identities, e.g. species, and the genetic 'numbers' do allow us to say that something is more or less related to something else. However, genetic analysis does less for the job of coupling <u>why</u> things changed. The beaks of Darwin's finches were breathtaking in power and simplicity because they came with explanatory guesses that included the varying environmental needs and pressures of the finches that allowed us to see their divergence. Both viewpoints have their flaws and are hindered if the other is excluded. The concept of a unit, a gene, meant to apply as a universal term that brackets <u>all</u> meaningful units not only borders on the metaphysical but cuts out truly meaningful

relations. As a result, a complete understanding of evolutionary change must incorporate both the identifiable units that remain across evolutionary change as well as the interwoven causal relationships between those units.

# CHAPTER V

# SURVIVAL OF THE FITTEST LAWS OF NATURE:

# PEIRCE AND THE FALSE PARADOX OF HYBRIDS

And for all this, nature is never spent;
There lives the dearest freshness deep down things;
-Gerald Manley Hopkins[192]

## Introduction

C.S. Peirce's scientific metaphysics has significant relevance for contemporary problems within biology. This essay will specifically address interactions between Peirce's tychism and his work on the law of large numbers as applied to hybridization. Within discussions of mate choice and sexual selection, the paradoxical problem of hybridization concerns, on one hand, its ubiquitous presence across all areas of life, and on the other hand, the high fitness cost that usually occurs for the individual that hybridizes. Stated simply, if a strict understanding of probability and natural selection were true, the behavior of hybridization should be gradually eliminated by selection forces. However, it does occur, and in high frequency in almost all areas of biological life. Peirce's non-reductionist interpretation of the probability calculus provides to evolutionary theory a more satisfactory explanation of hybridization than many versions

192 Gerald Manley Hopkins, "God's Grandeur," in *Poems of Gerard Manley Hopkins,* ed. W. H. Gardner (New York: Oxford University Press,1948), 70.

of contemporary evolutionary theory. He does so in two ways, first, by breaking from the mechanistic paradigm that comes from defining natural selection as an undeviating natural law, and secondly, by proposing that laws themselves continue to evolve. Peirce can account for the perceived randomness of individual hybrid encounters by applying a non-Bernoullian version of the law of large numbers, as well as through the concepts of absolute-chance and habit-taking that are the backbone of his tychism. The conclusion being that it is no more unnatural to hybridize than it is to get four 'tails' in a row when flipping a coin. The necessary condition for the continuation of biological life is that it tends toward survival, and taking into account probabilistic tendencies that act as a guiding final cause, we can find a place in our explanatory models for seemingly random occurrences such as genetic mutation and hybridization. Placing these concerns within the discussion of contemporary biology, I hope to make the case that Peircian metaphysics can greatly contribute to evolutionary theory and explanations of biological change.

This paper will address Charles Sanders Peirce's potential contribution to a related series of major questions in evolutionary biology. Given the contemporary conflict over the placement of hybridization within our understanding of evolutionary biology, it turns out, that Peirce has offered a remarkable foreshadowing of the direction we should take to resolve this conflict. C.S. Peirce took as motivation for his cosmology the need to explain both general and universal traits, and the following questions are representative of that. The task at hand is to investigate the overlap in three questions between evolutionary biology and those that motivated Peirce's

metaphysics: 1) Developmental growth and the trend towards increasing complexity, 2) The variety and diversity of living things, 3) Laws of nature and their regularity.[193] These issues are problems for a Darwinian mechanistic theory of natural selection in that they at first glance require an explanation not readily apparent from the theory itself, or which requires unfalsifiable assumptions about the teleological direction of evolutionary change. That these major questions are still in need of explanation can be attested to by their continual lingering-on as major problems in the discipline. Placing these concerns within the discussion of contemporary biology, I hope to make the case that Peircian metaphysics has potentially significant application for problems of causal explanation within evolutionary biology. Before addressing these specific issues, the next section aims to provide a review of the aspects of Peirce's scientific metaphysics, which are most pertinent to the discussion at hand. It is by no means meant to be exhaustive of the philosopher's work on this area but is an attempt to provide the groundwork for an interpretative application of his tychism. In particular, there is a lack of discussion of the two other major components of Peirce's metaphysics, synechism and agapism, which are present but not addressed specifically.

The connection between Peirce's work and the themes in the rest of the dissertation are threefold. First, the concept of habit-taking offers an origin of the constraints of development that are the subjects of the chapters on Goethe and Dewey. Secondly, his emphasis on absolute chance as a fundamental feature of reality provides a

193 Charles Sanders Peirce, *Collected Papers of Charles Sanders Peirce*, ed. C. Hartshorne and P. Weiss, Vol. 1-6, and A. Burks, Vol. 7-8 (Cambridge, MA: Harvard University Press, (1931-1958), Vol. 6, 35-65 and Vol. 6, 613.

stark contrast to the metaphysical assumptions of a reductionistic and deterministic paradigm that is an overarching target of this dissertation. And thirdly, some of the bite of the anthropomorphism of Schopenhauer's World-Will on Peirce's account. Yet, Peirce still needs a motivating source for the initiation of the movement of his system that Schopenhauer can provide.

## Peirce's Scientific Metaphysics

Peirce's philosophy of nature has its intellectual roots in the *Naturphilosophen* movement within German idealism associated with such thinkers as Kant, Schelling, Schopenhauer, Goethe and Hegel, among others. Of particular importance for Peirce's metaphysics is their understanding of organic development and telos as a universal trend among organisms and all living things. Peirce went so far as to say in a letter to William James that "If you were to call my philosophy Schellingism transformed in the light of modern physics, I should not take it hard."[194] In Andrew Reynold's detailed treatment of Peirce's work on chance and evolution he describes Peirce's metaphysics as "Hegelian dialectical idealism meets Darwinian evolution and statistical thermodynamics."[195] The perspectival lenses of physics and thermodynamics are no small feature of Peirce's worldview, but it is the specter of *Naturphilosophen* influence in his metaphysics that is most useful for providing causal explanation of hybridization. In an 1884 address to the Johns Hopkins University Metaphysical Club, later published

194 Peirce, *Collected Papers,* Vol. 6, 415.

195 Andrew Reynolds, *Peirce's Scientific Metaphysics: The Philosophy of Chance, Law, and Evolution*, (Nashville, TN: Vanderbilt University Press, 2002), 6. A great deal of my initial interest in this subject is indebted to Reynolds's work.

as "Design and Chance" Peirce initiates his contention that the laws of nature and of physics are not fixed and final but are in fact evolving. This "evolutionary explanation of the laws of nature"[196] became solidified in Peirce's tychism by 1892's essay, *The Doctrine of Necessity Examined* and posited "absolute-chance" and "habit-taking" as the fundamental backbone for all explanations of evolutionary change, inclusive of both the organic and the inorganic, both the biological and the physical.

The phrase "absolute-chance" here has a very specific definition. Robert Burch in his recent essay on probability shows that Peirce had a very definite distinction between two different interpretations of the probability calculus. Peirce referred to the two views as the conceptualistic and materialistic view, which we will refer to under their current labels of subjectivistic and objectivistic. Peirce was a defender of the objectivistic view, but not because he thought that the subjectivistic position was wrong, one just also needs to include the objectivistic position. The problem as he saw it was that the objectivist view was largely ignored, and worse, that: "Most writers have mixed the two conceptions together."[197] Burch notes that "Peirce's point was that subjectivism cannot be basic and autonomous. It must be posterior to and derivative from objectivism."[198]

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196 Charles Sanders Peirce, *The Essential Peirce,* ed. Christian Kloesel and Nathan Houser (Bloomington, IN: Indiana University Press, 1992), Vol.1, 215.

197 Charles Sanders Peirce, *Writings of Charles S. Peirce: A Chronological Edition*, ed. Max Fisch, Christian Kloesel, and Nathan Houser et al. (Bloomington, IN: Indiana University Press, 1982), Vol. 3, 291.

198 Robert Burch, "If Universes Were as Plenty as Blackberries: Peirce on Induction and Verisimilitude," *Transactions of the Charles S. Peirce Society* 46:3 (2010):423-452, at 432.

The subjectivist position tends to be an implication of mechanism and determinism associated with familiar concepts such as Laplace's Demon and Einstein's claim that "God does not play dice with the universe." It holds that there is no actual chance in the universe. When we ask what the chance of something is, it is a guess about what will happen based on the individual's subjective knowledge and view of things. If all knowledge was possessed by an individual, say Laplace's demon, the concept of chance would be meaningless because it wouldn't require a guess based on incomplete evidence. For instance, asking what is the chance of rolling a six, or of drawing a heart or a diamond, there is a knower that is involved in that assessment, the truth of the matter is already a fact set in stone due to the inalterable laws of the universe. Chance, as seen by the subjectivist is a conceptualistic interpretation on probability undertaken with the assumption that if we had a God's eye view of the universe, the activity of the universe would be shown to be uniformly determined.

For Peirce and the objectivistic position, there is a potential for things to come out in different ways, chaos (in the ordinary sense) exists in the universe, and probability is a metaphysical reality "deep down in things." Our knowledge and beliefs about something do not alter this objective probability; it is an imbedded component of the physical world and is by definition opposed to determinism. The Peircian concept of *objective probability* is useful in showing that the apparent paradox of hybridization discussed in later sections is not a paradox at all, but a byproduct of the subjectivistic view of chance in combination with a deterministic understanding of natural selection.

For evolutionary biologists the lack of separation between the objectivistic and subjectivistic views leads to a muddied understanding of evolutionary change, and yet, is often relied upon in assessing the probability of why such change occurs. The term absolute-chance used by Peirce in 1884's "Design and Chance" involves a further distinction within the objectivistic interpretation. Ordinary-chance is distinguished from absolute-chance in the following way. Absolute-chance suggests that there are actually swerves in the laws of nature, indeterminacy. Peirce discusses his impression that absolute-chance does not frequently occur: "I suppose that on excessively rare sporadic occasions a law of nature is violated in some infinitesimal degree; that may be called *absolute chance*; but ordinary-chance is merely relative to the causes that are taken into account." [199] Even chaos theory and catastrophe theory are deterministic in that they are subjectivistic, the position that I understand Peirce to be suggesting allows deviations from the laws of nature themselves. They are mostly held in place because of the momentum of the habits taken by the universe, but they can be deviated from. This is extremely relevant for the discussion of hybridization in later sections, because for the most part ordinary-chance dictates mate choice and offspring success, but it is the "excessively rare sporadic occasions" of hybridization that can redefine a species because "a law of nature is violated in some infinitesimal degree."

Before addressing hybridization in further detail it will be helpful to spend some more time untangling this distinction between ordinary and absolute-chance, which lies couched in the objectivist/subjectivist distinction. Ordinary-chance is similar in

199 Peirce, *Essential Peirce,* Vol. 1, 219.

structure to the law of large numbers and holds that the number of times that an experiment is performed the closer it will come to the limit. A recurring example throughout this essay is the coin flip of a fair coin with two sides. In each individual coin flip there is ordinary-chance – we know this chance to be 50/50 because of immense experience and by the definition of what a fair coin would mean. Yet, it would not be outside of ordinary-chance to get 10 heads in a row, unlikely, but not outside of the scope of ordinary-chance. In a million flips we would not think it possible to get all heads, although this too is possible but improbable on a large enough scale. The essential component of ordinary-chance is that there are conditionals that are set possibilities. In contrast, absolute-chance has no conditionals, and sometimes for no reason at all the laws of nature swerve. It is difficult to apply this example to the coin flip example because it is couched in conditionals, absolute-chance would, by definition, not be predictable, because if it was we could put it into the ordinary-chance equation as possible but unlikely. In other words it is a violation of the Principle of Sufficient Reason. Going forward I will refer to ordinary-chance when I mean the more general interpretation of Peirce's probability calculus that resembles the law of large numbers, and absolute-chance when referring to the more rare swerving of the laws of nature.[200]

There is a tension between the common understanding of random events and the predictable probabilistic tendencies that the random events are thought to produce. One way to formulate the problem is to ask how random events can result in a predictable

200 The use of the hyphen in ordinary-chance and absolute-chance is rhetorical and is intended to separate the use of a technical term from casual uses and understandings of the terms ordinary and absolute.

result. Let's take the flipping of a coin and the expected result of a 50% spread for either heads or tails given enough flips. When we say that we know that the odds are 50% to get heads there are many assumptions at play including the reliance on a great deal of experience, data, and trustworthy instruments to gather and record the experiment. Interesting in this regard is the trend towards increasingly uniform results the more one repeats the experiment. This, in short, is what was proved by the Swiss Bernoulli brothers working on probability. The idea is as follows: if the probability of an event **E** is equal to **X** then as the number of experiments approaches infinity the limits become more and more close to **X**. The upshot for the discussion at hand is the conclusion that each experiment is isolated from the previous one. It wouldn't matter if we only counted the odd or even flips, or who did the flipping. One is said to commit 'the gambler's fallacy' by not taking seriously the idea that each flip is disconnected from the previous flip. For example, in four coin flips it is conceivable that you could produce four 'tails' in a row. The fallacy term is applied to those who think that because you got four in a row that this impacts the probability of getting 'heads' the next flip. The relevant aspect of this problem is that although you cannot apply the previous flips result to the future flips, you can presume that if one were to perform the task a large number of times the result would be predictable. In other words, history does not shape the result in the short term, but history in the long term is predictable.

Within a closed system ordinary-chance and Bernoulli's law of large numbers offer some explanation. However, for Peirce, the gambler's fallacy derived from Bernoulli's laws of large numbers does not apply to nature. As a result, his tychism is

strongly non-Bernoullian. The distinction comes down to whether or not you consider the ordinary-chance guiding objective-probability to be more real than the absolute-chance possible in each individual event. When we consider the individual only, and not the set of all individuals, there is no necessity and objective-probability is real and easily accepted. Probability is a factor in both the coin-flipping example and in the biological one. The important difference is that in the biological context a statistically improbable event may initiate a major shift in evolutionary trajectories that is irreversible. It is too anthropomorphic to say that nature has a memory. That being said, all living things exist as a result of a long ancestral history, and the continued existence of future descendants might happen only if a statistically improbable event occurs.

**Popper's Propensities and Peirce's Absolute-Chance**

Peirce faced up to the problem of absolute-chance as early as 1884 when his work was deeply connected to the difficulty of attaining accuracy of measurement and removing measurement error. Peirce's willingness to accept fallibalism in this regard led to the abandonment of the pursuit for perfect accuracy, as he "finally surrendered to the idea that there is absolute-chance in the universe."[201] As a contrast, Karl Popper, who is perhaps more well-known regarding work on probability, does not as quickly adopt this position. Popper maintains a subjectivistic sounding view in his early work regarding probability in physics: 'it is possible to frame the rule in such a way that the dividing line between what is permitted and what is forbidden is determined, just as in

201 Ian Hacking, *The Taming of Chance* (Cambridge: Cambridge University Press,1990), 215.

the case of other laws, by the attainable precision of our measurements.'[202] Notably, in the same text Popper struggles with a paradox regarding the emergence of predictability out of initially random situations, which he describes as '[t]he seemingly paradoxical inference from the unpredictability and irregularity of singular events to the applicability of the rules of the probability calculus.'[203] In other words, there is chance in the flipping of an individual coin, but flipped a thousand times there is a concrete trend. This paradox is precisely the one that confounds thinking about hybridization, and will be addressed in later sections. For Peirce, the problem of probability was shaped by the metaphysical existence of absolute-chance as an underlying component of the universe. Popper was less willingly to accept this assumption and instead focused on explaining this paradox through his work on propensities. In 1957 Popper addressed the dichotomy between determinism and indeterminism and suggested that it wasn't a simple concept of indeterminism that was at work in chance, but that there were new forces constantly springing into the physical world that were preventing the deterministic trends from becoming fossilized.[204] This signals a move more closely resembling Peirce's objectivistic probability. Popper's concern over this paradoxical problem in 1966 led him to say that the confusion was due to "the problem which arises from a physical theory which describes the world as…a *physically closed* system."[205] Peirce's evolving physical laws are <u>not</u> subject to this problem. Popper's later work, specifically *A World*

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202 Karl R. Popper, *Logik der Forschung* (Vienna: Julius Springer Verlag, 1935), section 68.
203 ibid, sections 49 and 64
204 Karl R. Popper, "The Propensity Interpretation of the Calculus of Probability and the Quantum Theory," in *Observation and Interpretation in the Philosophy of Physics*, ed. S. Korner (London: Butterworths, 1957), 65-70. See section 4 in particular.
205 Karl R. Popper, *Of Clouds and Clocks: An Approach to the Problem of Rationality and Freedom of Man* (St Louis, MO: Washington University Press, 1966), section 7.

*of Propensities*, moves past this apparent paradox by positing something similar to Peirce's absolute-chance as a fundamental feature of his work on probability. This move has led some to criticize Popper for leaving science and entering into the metaphysical.[206] Yet, this move caused Peirce little difficulty. Popper's later work on propensities took on a decidedly pluralistic and pragmatic tone when he notes that "it was only in the last year that I realized its cosmological significance. I mean the fact that we live in *a world of propensities*, and that this fact makes our world both more interesting and more homely than the world as seen by earlier states of the sciences."[207] By earlier states I take him to be referring to a necessetarian deterministic worldview, one that is very much alive in some forms of contemporary biology. The turn from subjectivist-chance to objectivistic-probability is complete at this point. Indeterminism is a fundamental feature of reality. It is unclear whether Popper is an objectivist in the ordinary sense or whether the 'world of propensities' includes something as radical as Peirce's absolute-chance.[208] The implications for accepting absolute-chance as a fundamental feature of reality is crucial to the discussion of hybridization and ecological relations that occurs later. I introduced Popper's struggle with propensities not to claim that Peirce somehow had the upper hand with his concept of absolute-chance, but to show that there is a solution to this paradox that is often disregarded because it requires a fundamental shift in our understanding of casual explanations. A shift that looks much more 'quantum' than it does Newtonian.

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206 D. Gillies, *Philosophical Theories of Probability* (London: Routledge, 2000), 17.
207 Karl R. Popper*, A World of Propensities* (Bristol: Thoemmes, 1990), 9.
208 See D.W. Miller, "Propensities and Indeterminism," in *Karl Popper: Philosophy and Problems,* ed. A. O'Hear (Cambridge:Cambridge University Press, 1996), section 4.

## The Organic and Inorganic of Physics and Biology

Herbert Schneider in his classic history of American philosophy notes that Pierce applied the *Naturphilosophen* concept of nature to physics:

> From absolute idealism Peirce took over an evolutionary idea, quite different from the popular concept of "development" or "unfolding": the universe, which was at first mere chaos, is gradually becoming an orderly, intelligible being by acquiring "habits of mind.[209]

Peirce not only applied concepts usually reserved for physics to the biological world but he nearly elevated the habits of the biological world to the status of natural law.[210] A law, however, that is incomplete and continues to acquire new habits and further ingrain the ones already in place. Thirdness, having to do with the acquiring of habits,[211] is a Peircian concept that we understand as being related to mind and will; Peirce argued that there was no ontological distinction between mind, matter, and law. Accordingly, he contends that there is no reason to assume that it is biological organisms alone that have the ability to acquire habits over time. It is comparable to natural selection for habits of law. Schneider describes the process as follows:

> The primeval spontaneity gives way to regularity. Individuals move together in reciprocal tension or "struggle", holding each other in place. Matter's law-abidingness is by no means evidence of a purely mechanical order; on the contrary, in so far as it is orderly it exhibits mental traits...regularity grows or spreads…The natural attraction which orders things into classes or species is the basic principle of evolution: it is purpose, desire, or evolutionary love…[212]

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209 Herbert W. Schneider, *A History of American Philosophy* (New York: The Liberal Arts Press, 1946), 202.

210 Peirce shares with Schopenhauer the belief that their metaphysics was universal in its application to biological and non-biological entities alike. The laws of reality affect all of its incarnations.

211 "Peirce believed, on the contrary, that we actually experience generality, a connectedness or continuity among ideas in the form of patterns and regularities that he called *Thirdness*..." Reynolds, *Peirce's Scientific Metaphysics,* 10. "Thirdness is the category of relationship, of mediation, and of law and regularity. It is represented by the rendering of formerly discontinuous things into a continuous whole." ibid, 20.

212 Schneider, *A History of American Philosophy*, 202.

There is a strong connection here to contemporary theory regarding the evolution of altruism in social organisms as diverse as bees, ants, and the bacteria D. Discoidium.[213] Behaviors that are beneficial to the group are lifted up and as the habit becomes increasingly ingrained, cheating becomes less regular and more uniformly punished. A similar principle is operating between the coin-flipping example that produces a relatively predictable and *expected*, long-term probability, on the one hand, and the creation of laws of nature on an evolutionary model in which the law emerges out of the repetition of numerous chance individual actions on the other. This is a radical position when placed in relation to the kind of *necessatarianism* that posits that laws are more metaphysically real than the individuals that they rule over. Again, the missing factors of non-Peircian metaphysics are habit-growth and objective-probability. When they are removed universals more easily emerge and fallibility is minimized leading to a deterministic status for reality. In the worldview that Peirce puts forth they cannot be removed, even in our theoretical law making, as they are a description of how natural laws evolve.

> Once you have embraced the principle of continuity, no kind of explanation of things will satisfy you except that they *grew*. The infallibilist naturally thinks that everything always was substantially as it is now. Laws at any rate being absolute could not grow. They either always were, or they sprang instantaneously into being by a sudden fiat like the drill of a company of soldiers. This makes the laws of nature absolutely blind and inexplicable. Their why and wherefore can't be asked. This absolutely blocks the road of inquiry. The fallibilist won't do this.[214]

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213 See e.g., K.R. Foster, G. Shaulsky, et al, "Pleiotropy as a mechanism to stabilize cooperation," *Nature* 431:7009 (2004):693-696.

214 Peirce, *Collected Papers,* Vol. 1, 17.

In other words, laws must be connected to the thing they have law over. In the next section, we will explore this conception of laws as being necessarily connected to individuals, but in themselves not necessary, transcendent, or outside of time.

## Habit-Taking and Channels of Constraint

Peirce himself claimed to have proved his tychism, but he never released the work because he thought that the mathematical community would not accept his unconventional proofs. This work has not been found in his papers, however, David Dearmont (1995) attempted to provide an example for what this evidence might look like. Dearmont performed a computer simulation of Peirce's example in "Design and Chance" of a large number of players betting on a large number of coin tosses where the gamblers were able to take on habits depending on their previous tosses. It is distinctly non-Bernoullian because of the ability for the players to acquire habits based on previous experience. He concludes "[T]he results are just as Peirce predicted: the winners and losers are separated by a wider and wider margin as the number of tosses increases…These intriguing outcomes demonstrate that absolute-chance and habit-taking are indeed able to move things from a state of homogeneity to a state of heterogeneity."[215] The application of this to the trend for an increase in species is useful.

Peirce's version of Bernoulli's more traditional take on the law of large numbers is also connected to his concept of what he calls "nonconservative" laws or actions.

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215 David Dearmont, "A Hint at Peirce's Empirical Evidence for Tychism," *Transactions of the Charles S. Peirce Society* 21:1 (1995):185-204, at 193.

Nonconservative actions are both irreversible and working towards some final end, final ends that are final causes such as the equal dispersal of gas in a closed system.

> It was found that the kinetical theory would account, in a remarkably satisfactory way, for non-conservative phenomena. It accounts for these phenomena…by representing that they are results of chance; or, if you please, of the law of high numbers; for it is remarkable that chance operates in one way and not in the opposite way.[216]

In other words, chance has a direction, a tendency, a telos – and this direction is irreversible. Dearmont notes that "Habit-taking can take one of two forms, either a tendency to *reinforce* previous outcomes or a tendency to *counteract* previous outcomes. But, according to Peirce, the main form of habit-taking is that of reinforcement."[217] The analogy here is the formation of a stream of water through the taking of a habit from a random starting point of rain coming down. The flow of it when it hits the ground is initially random but over enough time, *channels* begin to form, channels that lead to constraints about where future water will flow. This channel forming is like the creation of a habit. What it might mean is that most water ends up flowing in one direction in one channel, but what it doesn't mean is that the rain stops falling at random and always lands in the river. The whole process continues to rest on a random starting point that is never removed. The channels themselves are also not permanent and are themselves subject to larger forces of channeling or having their banks erode or be redirected.

The fact that Peirce thought tychism applied to both physical and biological systems is crucial, and is helpful for the comparison between channels and the effort to

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216 Peirce, *Collected Papers,* Vol. 7, 221.

217 Dearmont, "A Hint at Peirce's Empirical Evidence for Tychism," 187. In reference to Peirce, *Essential Peirce,* Vol. 1, 223.

define what constitutes a species. Laws of nature are similar in this regard in that they are also eroding and being diverted but for the most part are constrained by their historical reaction to initially random events. Turning to the question of sexual selection, of who mates with whom, one of the most prevalent constraints is simple association time.[218] The result is a channel in the Peircian sense, but there are so many erosions due to pre-zygotic mating mechanisms (e.g. pollution) or diversions (predation or introduction of invasive species) that the channels of species are bound to be in flux and flow outside their banks. Note the tone here that assumes that if hybridization occurs it is because something has gone wrong and it might lead to extinction (Lake Victoria) Contrary to its public perception, hybridization is not a negative, it is equivalent to the random falling of rain that is falling outside of the purview of existing channels. Whether it is an outlier (ordinary-chance) or the shifting of the channels themselves (absolute-chance). This leads to the erosion of existing channels and the carving out of new ones, particularly if it happens to create a strong enough stream that finds a less obstructed and more downhill path. For Peirce, this is a direct contrast to the metaphysical understanding of the universe as understood by the determined mechanical laws of *necessatarianism* or mechanical philosophy. Within this discipline are those, including Ernst Haeckel, who thought that all phenomena could eventually be reduced

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218 See C.A. Walling, N.J. Royle, J. Lindstrom, N.B. Metcalfe, "Do female association preferences predict the likelihood of reproduction?" *Behavioral Ecology and Sociobiology* 64:4 (2010):541-548. G.G. Rosenthal, M. Ryan, "Conflicting preferences within females: sexual selection versus species recognition," *Biology Letters* 7:4 (2011):525-527.

to, and explained by, deterministic laws of physics and chemistry. Peirce's tychism is in direct opposition to this and suggests that indeterminacy is a fundamental feature of reality, and that consequently the laws of nature are not static as they do not govern a fixed universe. For instance, a robust concept of growth does not fit with a mechanical universe, as each individual finds itself in a unique starting place, and is always constrained and continuing on from previous growth. Peirce discusses it as follows:

> The law of the conservation of energy is equivalent to the proposition that all operations governed by mechanical laws are reversible; so that an immediate corollary from it is that growth is not explicable by those laws, even if they be not violated in the process of growth.[219]

The complexity and randomness of individual bodies moving in time does not produce a series of steps that can be repeated, in that we can't simply reverse back to the original state. Contemporary developmental biology makes similar claims, once a switch has been flipped (e.g. methylation in epigenetics) there is a cascade of consequences. For example, much like the dispersal of a gas in a closed system, in a model ecological system where all things are equal, over enough time and without limitation and impediment, we can expect a population of organisms to expand throughout and up to the limits of that area. The point of this analogy is to suggest that the principle of growth and the teleological disposition of ordinary-probability/the law of large numbers is the same in all things, it is law-like, most importantly for the discussion at hand is its translation to biology. Note in the following passage how Peirce includes the growth and development of organisms in between, and as equal to, the predictable, yet individually chance-ruled, bouncing of molecules:

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219 Peirce, *Collected Papers,* Vol. 6, 14.

> Those uniformities of nature which present phenomena of irreversible actions-such as friction and other resistances, the conduction of heat and the phenomena of the second law of thermodynamics in general, chemical reactions, *the growth and development of organic forms*, etc – cannot…result from the laws of force alone, but are to be accounted as statistical uniformities, due to vast numbers of fortuitously moving molecules.[220]

This tension between ordinary probability and the teleological tendencies of the law of large numbers is not a problem that has been satisfactorily and conclusively addressed since Peirce did his work and the implications of indeterminism, are the most glaringly missing from biology. Not only has the tension not been resolved by empirical data, but the paradox of chance in a predictable system is largely ignored by contemporary science due to the desire for clean and tidy, isolated and closed systems. Whether it is for the production of pharmaceuticals or the identification of 'problem' genes, it is an uncontroversial statement to say that much of the mechanistic and *neccessetarian* metaphysics are still at work in biology.

Peirce is on to something when he injects both telos of the law of large numbers and absolute-chance into his explanation of how the existing channels of constraint came to be. Contrary to Bernoullian trials, Peirce contends that nature is not blind to its past and that habit-taking occurs in biological organisms in a similar fashion as the physical world. Bernoullian trials assume that each new event is independent of the previous events, "but, in the application of probabilities to the ordinary questions of life, it is often

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220 *The Century Dictionary*, ed. William D. Whitney (New York: The Century Co, 1895), 1927. Italics added. The entry written by Peirce regarded the meaning of the term 'energy.' From this passage, the phrase "fortuitously moving" is valuable for the language limitations of evolution theory. Within the literature of evolutionary biology the words that are often used to describe what Peirce deftly captures with the phrase "fortuitous moving" include "success", "survival of the fittest" and phrases such as "the victors of the evolutionary battle" among many others. All of this language is fraught with anthropomorphic, religious, or metaphoric undertones. Peirce's language avoids many of these phrasing problems.

an exceedingly nice question whether two events may be considered as independent with sufficient accuracy or not."[221] In other words, in any ecological setting, complete with the myriad of connections and consequences that occur with every action, the Bernoullian assumption of isolation does not hold. Nature is not a game of chance where the shuffling of a deck means that history is erased. Dearmont states it clearly: "[I]ndependence is an important issue because its violation is exactly what habit-taking entails."[222]

## Pragmaticism's Laws: Real and Yet Evolving

Placing the metaphysical reality of numbers aside, the question of the reality of biological laws is a very contentious issue. One way to interpret Darwin's explanation for the origin of species, is to interpret the meaning of a species as a sort of Platonic Form. The applecart overturning kicker of Darwin's theory is that these Forms are changing and in constant movement.[223] Placing a principle over an idea like the demarcating of species only makes sense if there are legitimately different species, and pragmatically speaking, that it makes a difference how they are different. Take for instance Ernst Mayr's classic definition of species, which separates out kinds by their ability to produce offspring with one another. This is a function-based definition, it would be a meaningless distinction unless offspring existed or could possibly exist to experimentally test the principle. A recurring problem in the species debate is how the

221 Peirce, *Collected Papers,* Vol. 2, 660.
222 Dearmont, "A Hint at Peirce's Empirical Evidence for Tychism," 195.
223 cf. Dewey, *The Influence of Darwin on Philosophy: And Other Essays in Contemporary Thought,* 1-19.

theory can account for the fact that historically the trajectory of the number of species goes from fewer in number to greater. Peirce's tychism and its principles of habit formation and absolute-chance, we can explain why the channels of species sometimes jump the banks and create a new offshoot. It also explains how "things [move] in the long run from a state of homogeneity to a state of heterogeneity."[224]

Just as the principle of ordinary-chance/probability tends to produce the same results because of the limiting factors and starting position, for instance, of the coin being flipped – so to do biological principles/laws reveal tendencies because of similar starting places and universal constraints. For example, despite being separated by an incomprehensible amount of time, the genetic similarities between fruit flies and humans allow research on fruit flies to produce drugs that treat such things as human brain tumors and help us to understand the developmental history of traits such as human limb development. The deterministic aspect is here, but there are still ordinary-chance at work in some channels of habit, especially those that are so deep that they aren't jumped, it just isn't viable to do so. Peirce's habit-taking explains how some aspects of a system stay the same and absolute-chance accounts for continuing diversity. There is a trend here that is guided by constraining factors of survival and reproduction. This is because biological laws must be over things that actually exist, and consequently they must incorporate survival and reproduction into their formulation. Peirce explains something like this in an 1897 letter to Christine Ladd-Franklin:

> The state of things in the infinite past is chaos, tohu bohu, the nothingness of which consists in the total absence of regularity. The state of things in the

224 Peirce, *Essential Peirce,* Vol. 1, 221.

> infinite future is death, the nothingness of which consists in the complete triumph of law and absence of all spontaneity. Between these, we have on *our* side a state of things in which there is some absolute spontaneity counter to all law, and some degree of conformity to law, which is constantly on the increase owing to the growth of *habit*. The tendency to form habits or tendency to generalize is something that grows by its own action, by the habit of taking habits itself growing. Its first germs arose from pure chance.[225]

Nancy Cartwright, in her 1980 article "Do the Laws of Physics State the Facts" argues, that contrary to commonly held beliefs, laws do not state the facts.[226] Under her revised definition of law, which has some concord with Peirce on this issue, the closer we get to talking about the truth, the less explanatory power the statements of a law have. If a laws matches up perfectly with a completely abstracted idea, it explains nothing. Peirce certainly means something unconventional when he speaks of laws and holds, with Cartwright, that laws which explain nothing are not laws at all. That is, no generalization can be made about something that is completely isolated because nothing which exists in total isolation. Aiming for the widest possible scope available increases the value of a law as it decreases its ability to tell us what is actually going on. The assumption is that laws, if they are to have universal explanatory power, must operate with a *ceteris peribus* assumption and reject as many auxiliary forces as possible. Now, if we did remove the 'all things being equal' assumption, there would be anomalies that would prove our generalizations false, or in the parlance of Peirce's tychism, "nature is literally infected with 'infinitesimal departures from law.'"[227] All it would take would be one auxiliary force not accounted for by our law and it would falsify our law, unless,

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225 Peirce, *Collected Papers,* Vol. 8, 317.

226 Nancy Cartwright, "Do the Laws of Physics State the Facts?" *Pacific Philosophical Quarterly* 61 (1980): 75-84.

227 V. Cosculluela, "Peirce on Tychism and Determinism," *Transactions of the Charles S. Peirce Society*. 28 (1992):741-755, at 742.

that is, we understand laws to be incomplete evolving entities. Peirce's evolutionary laws allow us to understand reality without a *ceteris peribus* assumption and without the risk of forgetting the non-permanent status of laws, species, and identities. The sheer magnitude of knowledge it would require to know all of the variables for any given moment acting on any given individual is, for Peirce, not something that we can reasonably expect. Accordingly, fallibilism should be the status quo in our experimental hypothesizing about laws and principles.[228] At best, we can isolate a trajectory, a probability, a fairly good guess - a guess that should never be confused, or represented as, the Truth.

> [Explanations] supply a proposition which, if it had been known to be true before the phenomenon presented itself, would have rendered that phenomenon predictable, if not with certainty, at least as something very likely to occur. It thus renders that phenomenon rational – that is, it makes it a logical consequence, necessary or probable.[229]

The knowledge of all forces and all future causal outcomes which would be needed to derive a law which matched reality would place us in the same absurdity as a Laplace's demon. Notable in this regard as well was the fervent hope that the completion of the human genome project would immediately produce a roadmap for the elimination of all human suffering. If we want to make laws and general claims about the world that explain the most, we must accept that they will only be probabilities and necessarily carry a *ceteris peribus* rider.

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228 Peirce, *Collected Papers,* Vol. 1, 171-173.
229 ibid, Vol. 7, 192.

## A Proposed Application to Hybridization

Peirce's metaphysics and the idea of evolving laws are helpful for addressing some of the key difficulties for the concept of hybridization. One way the paradox of hybrids is stated is as follows. Hybridization is a frequent event; and yet, hybridization is traditionally thought to produce offspring that are less fit. Darwin's mechanism for explaining evolution relied on the law or principle that those individuals with greater fitness produce offspring whose descendents will be the survivors and victors of the struggle against the environment across time. Therein lays the tension. Hybridization was assumed by Darwin (and consequently by many contemporary philosophers of biology)[230] to have a direct fitness cost for the offspring. As a result, the presumption towards hybridization events has historically been that they are a mistake, an un-natural occurrence that is a violation of the upward trajectory established by the laws of nature.

The historical debate over the adaptiveness of hybridization centered on whether or not the same mechanisms and explanations were at work in plants as those that were in animals.[231] This assumption has been largely shown to be false as molecular tools have demonstrated that hybridization occurs in both plants and animals. In fact, the intensity can be just as high, if not higher in some animals populations.[232]

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230 Darwin, *On the Origin of Species,* 276-277.

231 cf L.H. Rieseberg, "The nature of plant species," *Nature* 440 (2006): 524-527. J.M. Burke and M.L. Arnold, "Genetics and the fitness of hybrids," *Annual Review of Genetics* 35 (2001): 31-52. It is interesting to compare the structure of Darwin's argument in the Origin to what went on regarding plants and animals. Darwin pointed out that there was general acceptance of artificial selection and then showed how the same mechanisms (minus human intervention) could lead to natural selection. Plant hybridization has long been accepted as adaptive and useful within human culture, so why is it viewed in a negative light when it occurs in animals in the wild?

232 J. Mallet, "Hybridization as an invasion of the genome," *Trends in Ecology and Evolution* 20 (2005): 229-237.

Karin Pfennig has done work on spadefoot toads that demonstrates an exception to the usual assumption that hybridization is necessarily costly.[233] Discussing her work Heinz-Ulrich Reye in a 2008 paper interestingly titled "Mating with the wrong species can be right" notes that when the two spadefoot species (*Spea bombifrons* and *Spea multiplicata*) live sympatrically, they hybridize. However, all males are sterile and females are 50% less fecund. Given this high cost to hybridizing it is surprising that they still do so. However, Pfennig has shown that there is an environmental condition in which hybridization is adaptive. If the water level is low the ponds can dry up before offspring can reach maturity. In this situation one of the hybrid combinations might be adaptive because, although costly in other areas, it has been shown to mature and reach metamorphous two days faster than the parental population. Pfennig made the startling and unusual prediction that if the water level was at a dangerously low level that mate choice would favor hybridization. Further research proved her prediction was right.

The main empirical problem with the assertion that hybridization is a temporary deviation is that hybridization is extremely common. It is more of an anomaly to find a species that does not engage in at least attempting to hybridize with other species. Another possible explanation for the negative sentiment towards hybridization is the notion that once speciation has occurred then the species are forever separated. However, some fish populations that have diverged and speciated as long as 20 million years in the past are still able to hybridize. It is estimated that 88% of fish species are

233 K.S. Pfennig, "A test of alternative hypotheses for the evolution of reproductive isolation between spadefoot toads: support for the reinforcement hypothesis," *Evolution* 57 (2003): 2842-2851. K.S. Pfennig, "Facultive mate choice drives adaptive hybridization," *Science* 318 (2007): 965-967.

able to hybridize with one another and about 55% of mammals.[234] The benefit of backcrossing has been largely ignored and this bias might have led to much of the hesitation behind accepting Neanderthal and human breeding as a viable component of our shared anthropomorphic history.[235] In summary, if hybridization is always statistically an unproductive strategy, and laws were also subject to selection, then the principle of hybridization should be less codified as a universal trait than it is.

Perhaps most importantly is that there also exists behind the negative sentiment towards hybridization a reliance on the law of large numbers. The failure to distinguish between absolute-chance and ordinary-probability leads to the apparent paradox of ubiquitous hybridization and heavy selection against it. Using the previously discussed parlance of channels, we can say that speciation events symbolize fairly deeply ingrained channels and that Peirce can help show that the paradox is a false one.

The Peircian insertion of absolute-chance into the initial equation, coupled with an understanding of species as semi-permanent habit channels that are being eroded and revised, leads to a clear explanation of how species channels are initially formed and why they are not permanent. This is central to how Peirce can help us to understand why species tend to become more heterogeneous rather than becoming more homogeneous, namely diversity arises as a fundamental component of nature and occasionally modifies

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234 Ole Seehausen, Gaku Takimoto, Denis Roy, and Jukka Jokela, "Speciation reversal and biodiversity dynamics with hybridization in changing environments," *Molecular Ecology* 17 (2008):30-44.

235 See for instance the strength of the language used and the subsequent debate resulting from: J. Hodgson and T. Disotell "No evidence of a Neanderthal contribution to modern human diversity," *Genome Biology* 9:2 (2008):206.1-206.7.

the laws of nature, inclusive of the bounds of species, resulting in the creation of diversity.

> Suffice it to say that as everything is subject to change everything will change after a time by chance, and among these changeable circumstances will be the effects of changes on the probability of further change. And from this it follows that chance must act to move things in the long run from a state of homogeneity to a state of heterogeneity.[236]

Even if one does not accept the stronger metaphysical position of absolute-chance occasionally introducing a swerve into the laws of nature, then a weaker version of chance can still be informative for explaining how the 'laws' of a species occasionally change and consequently modify the identity of a population.

Before fully integrating Peirce's absolute-chance into explanations of hybridization it will be helpful to further illustrate the rut that the thinking on this issue continues to fall into into. By default, many take a mechanistic understanding of natural selection as an unquestioned guiding principle, and assume a delayed benefit of hybridization to many generations down the road. The result is a position that contends that the proof for natural selection operating within hybridizing populations is simply not yet present, but that it will be perceivable eventually. This is similar to the earlier discussion of Popper's and Peirce's views on the refining of our instruments and the removal of measurement error. Other contemporary explanations that are more subtly deterministic and non-Peircian contend that hybridization increases variation, and having variation increases plasticity, flexibility to environmental change, resistance to parasites, among other examples, and as such increases the size of the genetic material available to

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236 Peirce, *Essential Peirce,* Vol.1, 220-221.

the members of a population, while also keeping disadvantageous genes isolated to a sister population.[237] Genes can still pass from one population to another if something changes and what was previously disadvantageous suddenly becomes a boon for fitness, or if the sister population produces something novel that will also be beneficial in the parent population. This is all well and good, but the message of the contemporary solution is to say that hybridization as a principle is unfit in the short run for individuals, but in the long-run it can be good for the fitness of a whole population. Consequently hybridization is said to increase fitness and can still be said to be working within the bounds of the natural selection explanatory model. Such a message relies in part on a 'averaging out' probability model, along the lines of Bernoulli. Implicit here is a fairly convoluted understanding of natural selection, one which relies on an unverifiable assumption that there are forces in natural selection at work, the consequences of which, won't be made apparent until all the cards are in. This is not very helpful in explaining why hybridization events occur in the first place, or in offering a robust concept of a species that accounts for its perpetual change. To avoid the accusation that I am straw-manning all biologists, I should note that there is an uptick of attention paid to stochastic processes and positions such as Developmental-Systems theory that also criticize an overly mechanistic understanding of natural selection. However, I do not think that it has done enough to address the deep seated prejudice towards hybridization that associates it with a mistake or a misfire.

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237 For further discussion see R. Lande and S. Shannon, "The role of genetic variation in adaptation and population persistence in a changing environment," *Evolution* 50:1 (1996): 434-437. and Barton, "The role of hybridization in evolution," 551-568.

What stays the same in natural selection explanations of hybridization, which rely on hidden benefits, is that there is a mechanistic aspect of the law of natural selection.[238] Here, is where Peirce can offer an alternative paradigm. Peirce's conception of absolute-chance and ordinary-probability can be seen as being opposed to permanent laws of nature that are fixed and final and unrelated to the physical, chemical, and biological entities over which they govern. There is a paradigmatic difference between believing that natural selection, guided by fitness, is the necessary law that explains the survival and presence of an organism and contending that laws themselves are subject to evolutionary pressure.

Peirce can provide a model that explains the seeming paradox between randomness in individual events, on the one hand, and trends and probabilities on the other. The tenets of tychism, absolute-chance and habit-formation, explain why no species lineage remains consistent and yet offers an explanation of how the "habit" of a species existence can come to be in the first place, albeit only as a temporary channel that is consistently redefined and reshaped due to the continual injection of new variation into the equation. Most importantly, Peirce's explanation does not rely on unforeseen potential benefits in the future. One could contend that all Peirce's explanation does is swap an assumption about the future, with the metaphysics of his probability calculus.

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238 There are some similarities between this critique of biologists who assume there must be a natural selection explanation of hybridization and Gould & Lewontin's classic critique of the adaptationist program in biology. The primary difference between Gould & Lewontin and Peirce on this issue as I see it is that Gould and Lewontin provide a large list of alternative explanations of organic form in their paper, suggesting that although adaptationist explanations won't work there is still a determined reason out there that simply needs to be isolated and shown to have a necessary connection with the outcome. Peirce would leave us without any explanation at all of certain hybridization events and this may be unsatisfactory, but it avoids the dangerous assumptions of the paradigm of the Principle of Sufficient Reason applied to biology.

This may be unscientific to some, but to choose the alternative is to hold onto deterministic mechanism well after the paradigm has been replaced. One cannot legitimately be an advocate of quantum mechanics for the physical world, and yet hold onto Newtonian mechanics for the biological. Similar lingering on can be found throughout the discipline of philosophy, particularly those still trying to defend a simplified version of the Principle of Sufficient Reason.

Peirce can account for the randomness of individual hybrid encounters by pointing to the law of large numbers. It is no more unnatural to hybridize than it is to get four 'heads' in a row. There is no need to look for a cause of getting four heads in a row, and this, by definition, is what is meant by chance. It would be outside of what is expected if the event occurred a thousand times, but in any given individual event it is not unexpected that chance will impact the result.

## Swordtails: A Case Study

It should be noted that there are constraints to the flipping of a coin example as there are also constraints in any biological example. Heads and tails are the only options. Similarly, hybridization events are constrained, but by many other factors. An example of this situation is the swordtail system containing *Xiphophorus birchmanni* and *Xiphophorus malinche*, which are two sister species that are capable of producing offspring but prefer not to. They use olfactory and visual cues to differentiate conspecifics from heterospecifics when choosing mates. A brief discussion of these cues will be helpful for understanding how Peirce can help with an explanation for this

hybridization event. Although the discussion of this example has already been broached in the context of Schopenhauer, it will be helpful to reintroduce it in the context of Peirce.

The most notable visual cue is the sword of the swordtail, which exists prominently in *malinche* populations but not in *birchmanni.* Interestingly the ancestral *birchmanni* population possessed swords, and lost them. It has been suggested that the swords represent a false signal for body size and that this has been alternatively selected for depending on whether there is a great reproduction benefit to having offspring that are 'sexy' because of swords or whether the false sword signal can be selected against because of its more immediate fitness cost, namely that it requires the investment of limited resources to produce and reduces swim speed and predator avoidance.

The exact molecular olfactory cues are attempting to be isolated but this much is clear: *malinche* females prefer the visual cues of the tail-less *birchmanni* but prefer the olfactory cues of conspecific *malinche*. The olfactory mechanism appears to play a strong role in preventing hybridization as in this system, as in most systems, there is a greater likelihood that offspring will not survive if they mate with members of another species. There have not yet been found any wild caught examples of first generation hybrids between the *birchmanni* and *malinche* species, but there are many hybrids existing alongside and backcrossing with the parental species. Increasing the mystery is the fact that there are many backcrossed hybrids in the wild and in captivity, but it has been virtually impossible to produce viable hybrids between the parent populations in the lab so far. Under some situations this backcrossing has resulted in geographic areas

that are occupied by hybrid swarms, in that they are all hybrids. This makes sense as ordinary-chance and enough time could produce something like the melding of the two parental species if barriers are never constructed to isolate reproduction.

Within the Swordtail system there has been significant speculation about the cause of the original disturbance that caused the initial hybridization event. The echoes of this event exist today as the backcrossing of the hybrid population with the two parental species. One possibility is that the signal systems that they usually rely on to determine conspecifics from heterospecifics are jumbled by factors such as pollution due to deforestation and the masking of pheromones.[239] Or if they are in a situation where there are simply a large number of heterospecifics present, thereby increasing the role that chance might play.[240] More important for the discussion at hand is that there is often hybrid vigor in the hybrid populations. For instance, *birchmanni* are marathon runners, *malinche* are sprinters and do really fast starts when they are disturbed. Hybrids are both good sprinters and marathon runners, so they have a combination of traits that favor their survival.

Another trait of hybrid vigor that is often seen is increased body size, hybrids are often bigger than the two parental species giving them an advantage in competition for

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239 For another example of polluted and cloudy water disrupting the signal systems used in mate choice resulting in increased hybridization see: Seehausen et al, "Speciation reversal and biodiversity dynamics with hybridization in changing environments," 30-44.

240 For some further information about the work done on this system, see H.S. Fisher and G.G. Rosenthal GG, "Female swordtail fish use chemical cues to select well-fed mates," *Animal Behaviour* 72(2006): 721-725. and G.G. Rosenthal, F.J. Garcia de Leon, "Speciation and Hybridization," in *Ecology and evolution of poeciliid fishes*, ed. J. Evans, J. Pilastro, I. Schlupp (Chicago:University of Chicago Press, 2011).

mates. The concept of transgressive segregation explains the potential for hybrid fitness within the framework of ordinary-chance.[241] Transgressive works in the following hypothetical way. Say that there are ten alleles that are involved in body size in two separate species, A and B. In one species five are fixed for positive effects and five are fixed for negative effects. In the other species the five that are fixed for positive effects in species A are fixed for negative effects in species B, and the ones that are fixed for negative effects in species A are fixed for positive effects in species B. A hybridization event may then result in an individual that has ten positive alleles, and consequently are much larger than either of the parental species. Given that size increases the conspicuousness, these much larger hybrids would have a greater chance of attaining mates than either of the parent populations. In short, chance brings in combinations that weren't previously there and this shuffling produces individuals that may have a great impact on the future shape of the populations.

But what about all of the visual and olfactory reinforcement of mate preference between the parent species? What about the direct and indirect costs of hybridizing? In other words, why is this still happening? This is the mystery and a question that is an instance of the false paradox of hybridization. The answer under Peircian absolute-chance: of course they are going to hybridize. It would be a greater anomaly if they did not. The barriers that are constructed are relative to advantages that exist in a moving and shifting environment/channel. The original environmental disturbance that caused

241 L.H. Rieseberg, M.A. Archer, R.K. Wayne, "Transgressive segregatin, adaptation, and speciation," *Heredity* 83(1999):363-372.

the hybridization is no longer there, but Pandora's box is open, and most importantly, is never closed. Although the original swerve inducing event seems to have ended, the backcrossing of potentially useful genetic material continues. Ordinary-chance allows us to make predictions about what will happen given enough 'flips of the coin' or mating events between hybrids and parental species right now, but it is the concept of absolute-chance in conjunction with irreversible and continually developing constraints due to habit-taking that is most explanatorily useful and leaves open room for future swerving of the habits already taken. Even from unrepeatable chance, there is the injection of new variation into the previously closed system that alters the probabilities for the system. The cause of the original disturbance is not as relevant for the discussion as the assertion that in the future there will be another deviation that will go outside the bounds of expected outcome.

Understanding that this tendency to survival is only the average of a large number of coin flips or lives led; we can understand and explain seemingly random occurrences such as genetic mutation and hybridization as instead being bound by the constraints or ordinary-chance and infused with occasional freshness by absolute-chance. Both of which, on an individual basis, appear unexplainable if we were using an understanding of natural selection that was guided by permanent and absolute laws in a closed system. They are not aberrations; they are exactly what to expect on the small scale of individual events. Habits are taken, but they emerge and are not immediately present in all individuals. The current of any channel is usually under some selection-induced change, so instincts are constantly being outdated. Consequently, when we

take into account the rapidly changing needs of survival for an organism, and the evolving nature of the guiding laws themselves, the apparent random wanderings of genetic mutation or of mate choice are not an anomaly but an instance of the fundamental way in which reality itself behaves. Anomalies are expected. Anomalies make growth possible; without them, the system would become increasingly and irreversibly closed.

Falsifiability is a problem for evolutionary theory, and it is certainly a problem for mechanistic natural selection models that explain hybridization as having unforeseen benefits in the future. A Peircian understanding of chance, habit, and change does not completely avoid the falsifiability critique, nonetheless, there is one major empirical fact that can be claimed in its defense. If anomalies were not expected the system would become increasingly closed and there would be fewer and fewer species. In contrast, the trend here is that there are continual speciation events and more and more species. Randomness in natural selection, that includes random changes regarding what is selected for, offers an interesting explanation for this exponential growth of diversity.

# CHAPTER VI

# CONCLUSION

## Intangible Variation and Crayfish

One could criticize the position that has been presented here as being too overly generalistic about the assumptions of all biologists. Accordingly, it should be noted that room for something like absolute-chance has been left within evolutionary biology, but it has received little attention. When it has been investigated, this 'intangible variation' has continued to be largely understood on a deterministic framework in which the assumption is that the complete explanation is just a few steps away.[242] Whether the concept is stochasticity, 'intangible variation', 'developmental noise', absolute-chance or Brownian motion, there is a metaphysical disposition that is exposed depending on how these ideas are approached. Specifically, whether or not one has a belief in future research being able to fully explain all causation. Hope in humanity eventually becoming Laplace's demon.

One example of the impact of 'intangible variation' can be found in the marbled crayfish, Marmorkrebs. An all-female species of crayfish that reproduces parthenogenetically was shown in a 2008 study to respond to something like stochastic noise. Developmental variation was defined by Vogt et al as "that part of the phenotypic

242 For some instances of work on 'intangible variation' see: A.E. Peaston and E. Whitelaw, "Epigenetics and phenotypic variation in mammals" *Mamm. Genome* 17 (2006):365-374. B.L. Astauroff, "Analyse der erblichen Störungsfälle der bilateralen Symmetrie im Zusammenhang mit der selbständigen Variabilität ähnlicher Strukturen," *Z. indukt. Abstamm. Vererbungs* 55 (1930):183-262.

variation that cannot be explained by variations of the DNA sequence or variations of the macro-environment.[243]" Genetically identical clones of the crayfish were raised in artificially constructed but identical environments. The result was not identical individuals; instead, the adult clones displayed a wide range of sizes, colors, life spans as well as other phenotypic diversity. They concluded that the phenotype is determined not just by genetic and environmental factors, but also by "stochastic developmental events". The hope of the authors was that in the future these differences might be explained by multi-generational epigenetic change, which might eventually have explainable components, thereby, establishing the marbled crayfish as a model organism for future epigenetic research. This hope in the future is heuristically useful and I am not suggesting that it be replaced, only that it be understood as a heuristic only and separated from the belief that the underlying status of reality is necessary and deterministic and that a simple A caused B explanation is right around the corner.

One might respond that the appeal to absolute-chance is lazy, or that the indeterminate result is only because our instruments or investigations were not accurate or rigorous enough. Trevor Pearce noted in a commentary on a version of this paper that: "Another way to put this is to say that deviations from law might simply prompt a search for the law governing the deviations; Peirce's claim is that you're going to bottom out, but this is I think a difficult metaphysical question. Isn't it better for scientists to assume we won't bottom out?" We could say that the crayfish differences are the result

243 Gunter Vogt, Martin Huber, Markus Thiemann, Gerald van den Boogart, Oliver J. Schmitz and Christoph D. Schubart, "Production of Different Phenotypes from the Same Genotype in the Same Environment by Developmental Variation," *Journal of Experimental Biology* 211 (2008): 510-523.

of absolute-chance or we could say that our epistemic limitations are making it seem as though there is chance, when really the causes are just presently unknown. The debate between Clifford and James is telling here. What pragmatic difference would it make if we think of hybridization as a stochastic process or a deterministic causal one? In many cases I don't think that the belief in deterministic causes is damaging, however, in the case of hybridization and the closely linked concepts of inter-species and inter-racial language there is great potential for misuse. Given the choice between two unknowns, having unchecked faith in biological determined causation is far more risky. A belief in determinism in biology implies that if things are different, then they were always along paths that would make them different. The alternative path, an adopted pragmatic fallibilism, avoids the potential misuse of our hope for future knowledge to allow for anyone to assume, on faith, that we will someday soon know why things are different from each other, and suppose that they will justify our current prejudices about what matters about those differences.

When talking about the role that hybridization has on speciation, it lacks footing unless you include the random and chance variables of the transient and moving environment in which a population finds itself at any given time. In line with Peirce's tychism – the trait that is trending will eventually change when a new trend becomes more relevant to survival. The laws are in flux because what is evolutionarily successful to survival is never fixed or reversible, and the flow of time negates old trends. New channels of habit select for different sets of traits, but do not eliminate diversity, and leave open the possibility for tributaries to spring off of old channels.

Peirce helps us with these contemporary problems by having an explanation of laws which includes chance and argues that no law can be perfect or finalized. This imperfection applied to mate choice means it is only *probable* that species will mate within the confines of their species. The imperfection of the law can be empirically verified by the sheer magnitude of hybridization occurring in animal species, and this provides a basis for an explanation of the increase in variation, as well as an increase in specialization. Randomness and chance are not laws, because laws need an explanation, and by definition, randomness has no explanation. This simple addition to the formulation and application of scientific laws might act to place a cap on their empirical reach, thereby preventing false problems such as those regarding the supposed mystery of hybridization. A healthy dose of fallibility is certainly in order when discussing something as messy, terminal, and transient as biological life.

Take, for example, the experience of watching raindrops hit a lake. The 'normal' pattern of raindrops doesn't call out, or need, an explanation. However, if there were a clear spot in the lake where no rain was falling, it would inspire the *expectation* of an explanation and a cause. The occurrence of hybridization can be equated to the raindrops. Randomness does not elicit the need for finding an explanatory law. The randomness that sneaks into biological probabilities to not hybridize explains the existence of the phenomena. Like the clear spot on the lake, explanations can be found only when the natural state of randomness is broken. In other words, the explanation for hybridization is that we are over-expecting the non-fixed laws of biology to apply always and forever to all situations, and we are subtracting out the randomness from any

given state in hopes of a clear explanation. The cost of doing so is the creation of a perceived need to explain that which has no explanation, that being, randomness itself. In the context of a deeply intertwined ecological community, removing the randomness present in each fiber of each relation is to leave the empirical reality of a biological setting completely. Abstractly removing chance may be hermeneutically helpful in some cases, but it is not surprising that it results in an inability to explain evolutionary change. For Peirce, things become less chaotic as laws and habits prop each other up and produce constraints that lead eventually to predicable probabilities and trends. What is lost in the present understanding of hybridization is that time always produces new situations rife with chaotic possibilities; consequently probabilities remain only propensities as they are embedded within a reality that consistently renews chance. Although hybridization is the primary example discussed in this essay, I see many inroads for an application of Peirce in contemporary issues of philosophy of biology, including genetic drift, sexual selection, and explanations for the vast diversity of life. The upshot of which is that Peirce's tychism and emphasis on development and growth are able to absorb the lessons of Darwin and still be experimentally open to a conception of laws and evolution that is not fixed and final.

## Pluralism, Pragmatic Selection, and Fallibilism

There are several themes that are shared by Goethe's Metamorphosis, Schopenhauer's Will, Dewey's Growth, and Peirce's absolute-chance. Some of these connections are of the more difficult to capture and indefinite kind. One of these more

elusive connections is found in their shared interest in explaining how it is that the natural world came to be and how it's ever changing fluctuations aid in continuing its existence. They all attempt to offer an explanation for this phenomena, but do so with radically different languages and contexts. Gathering all of these philosophies of nature together results in more of a mood then in a congruent description of evolutionary change.

There are other shared features that are not explicit in that they are rejections of other ways of understanding biologically living things. For instance, all four have an evolutionism that is anti-mechanistic, anti-teleological, and which operates in an ever-expanding open system where truly unique content continually emerges. Seeing a continual freshness in nature makes permanent descriptions of it all the more difficult. We might try and take a different approach and tie all of these thinkers together by saying that they are just a representative handful of a romantic type of evolutionism that prioritizes holism. This is both true, and an unfairly simplistic way to describe a set of evolutionary theories that revel in nature's complexity. One example of this that was not touched on in much detail in this dissertation is how these four thinkers expanded their theories to the nonbiological. Dewey applied the idea of growth within the context of education, social development, and the ideas of a democratic society. Peirce is at heart a logician and expanded his metaphysics to all areas of investigation, particularly physics. Although no logician, Schopenhauer had the same intent and considered the Will to be best witnessed in living things, but present in both organic and non-organic tendencies. And yet, in all of these thinkers, despite this notion of the pursuit for generalized notions

of theory, there is a great respect for the world of biology, and the complicated, even messy, behavior of living things. Lovejoy translates Schopenhauer discussing this very issue:

> [T]he quest for causal explanation declares that it is its goal to eliminate all ultimate forces except one, the most general of all, which science flatters itself upon thoroughly understanding; and when, accordingly, it seeks to reduce by violence all other forces to this single force, it then destroys its own foundation and can yield only error instead of truth. It if were actually possible to attain success by following this course, the riddle of the universe would finally find its solution in a mathematical calculation. It is this course that people follow when they endeavor to trace back physiological effects to the form and composition of the organism, this perhaps to electricity, this in turn to chemism, and this finally to mechanism.[244]

It is not clear why the position represented by these thinkers requires more justification and defense than a reductionist mechanistic model. The problem seems to be the mistaken belief that our knowledge of the world is real in some permanent way. It is not clear if this is some version of naïve realism or maybe some over confidence in the powers of reason and a blinded trust in scientific authority.[245] For these reasons I have tried throughout this dissertation to suggest a view regarding our empirical claims about the natural world that is still useful and meaningful, but doesn't stray too far outside the bounds of what is knowable. If forays are made into the unknown, as they often are in philosophy and in science they are done without ever forgetting that doing so is only exploratory; a hermeneutic that keeps the coast line in sight.

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244 Lovejoy, *Schopenhauer as an Evolutionist,* 218. Lovejoy provides his translation of paragraph 27 of the first edition of *Die Welt als Wille und Vorstellung.*

245 Speaking of misusing scientific authority, Einstein also echoes a similar sentiment: "For what is thought to be a "system" is, after all, just conventional, and I do not see how one is supposed to divide up the world objectively so that one can make statements about the parts." Einstein in a note to Max Born in 1949, in D.A. Howard, "Albert Einstein as a Philosopher of Science," *Physics Today* (Dec, 2005): 33-40, at 37.

Throughout the discussion of Goethe, Schopenhauer, Dewey and Peirce I have used the words heuristic, worldview, or metaphysical framework in a somewhat interchangeable way. What is in embedded in all of these positions that have been presented here is a built, natural, innate, mode of selection that uses pragmatism as the knife that trims that which does not work. At the heart of each of these explanatory models is a search for finding out what makes something work and how does it work. The answer is defined differently by each of the thinkers presented and, if the pluralism that anchors any open ended pragmatic system is right, then it should not be surprising that each of them has a different take on how nature's pragmatic selection works.

The notion of pragmatic selection as a way to understand ecology requires the acceptance of fallibilism regarding our analysis of data. Because the rules guiding the data might change there, is the need constantly to be testing whether the presuppositions brought to our analysis of the data accords with a working notion of the natural world. Ambiguity, tychism, and ever-not-quite – these are the only ways to understand the irreducibly present complexity that is our experience of living things. The phrase ecology as it is presently used captures some of this mood, but its philosophical justification is still best expressed in its theoretical roots, namely, fallibilism, pragmatism, and pluralism. These four thinkers are exemplars of this worldview.

## The Meaning of Wild

The notion of wild that is presented herein is different from the traditional notion in that it doesn't mean not-civilized. Instead, wild as it is presented in Schopenhauer's

Will and Peirce's notion of absolute-chance is a non-rational and indeterministic underpinning to the fabric of reality. This Wildness is very much constrained, however, because wild things exist only as the result of a long history of pragmatic trial and error conducted by previous generations. Even the most unrestrained wild thing does not represent an individual example of extreme nominalism because habits and instinctual constraints are too powerful.[246] Wildness itself is pragmatic within this framework because it allows for experimental behavior that may chance upon something that presents an opportunity for growth. The wildness of previous generations that has proven to be pragmatically beneficial creates channels of constraint that are not frequently jumped. Nonetheless, the wildness is essential to prevent stagnation and the extinction that inevitably follows. This, in short, is the collected worldview of the four philosophies of nature presented.

Wild is a word that potentially suggests a lack of seriousness, but it is difficult to name something that by definition is without identity, and which is the factor added that ends previously established identities. This destructive, amoral, non-teleological element of the natural world is what gives it the flexibility to evolve in a way that mathematical truths do not, and which also gives it the power to create, both objects of beauty and catastrophic pointless suffering. The result is a worldview that falls between the extremes of intelligent design and mechanistic materialism. The downside is that it provides no quick and foolproof tools for deriving answers about the biggest questions

246 Hopefully not as powerful as Schopenhauer suggests.

concerning living things. The upside is that what is left is an experience of nature that causes us to stare and gasp at the very phenomena of its existence, and in turn our own.

The heart of this evolutionism is one of final causes; it is a balance between the constraining force of the momentum of ancestral history and the absolutely Wild behavior of presently living things. The position here is a delicate balance between two extremes. On one hand is the position of mechanistic determinism and all of the assumptions and implications therein, on the other hand is a complete nominalism in which all events are singles and are devoid of causal relation to that which has come before. It seems to me, and is a position held by the thinkers in question here, that an evolutionary theory of biological life requires that entities come and go, but do not come from nowhere even if that is where they might end up. In the long history of living things that we have available to us, there are those that have left vestiges in the form of other living things, and there are those whose only remnants are imprints in rocks. The individuals themselves all perish but the question about the identity of current things cannot be separated from the developing and changing identities of previous generations. What works? What allows some things to further the development of living things, but not others? This is the meaningful question of evolution, and it is also a pragmatic one. This dissertation has attempted to capture this sentiment.

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